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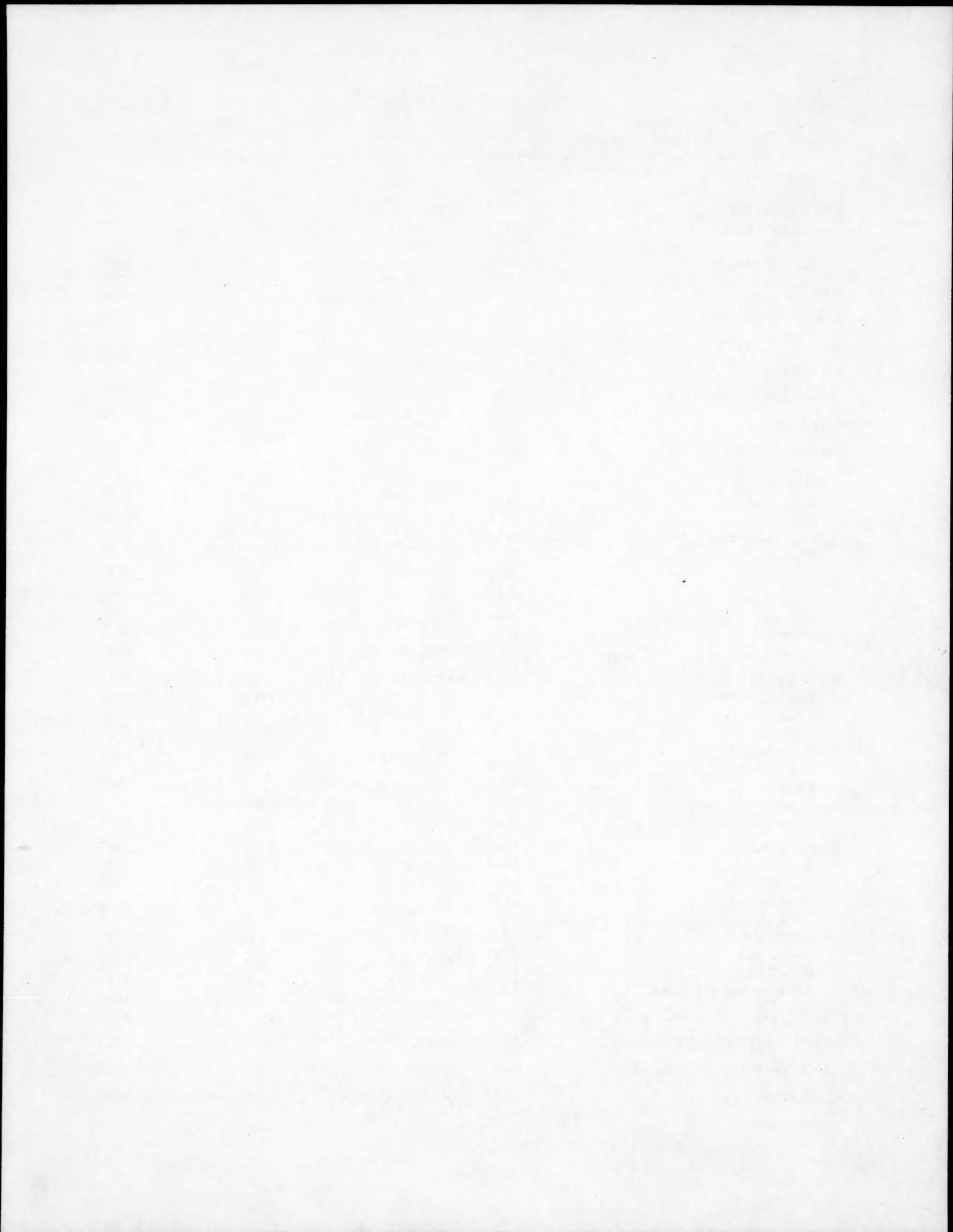
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AGRICULTURE

AGRICULTURE, GENERAL

A STUDY OF AGRICULTURAL EXTENSION COUNCILS IN MISSOURI, INCLUDING DEVELOPMENT, RESPONSIBILITIES, AND UNDERSTANDING OF POLICIES.

(L. C. Card No. Mic 60-6788)

Mercer Lamar Chason, Ed.D.
University of Missouri, 1960

Supervisor: Dr. G. F. Ekstrom

PURPOSE: The purpose of this study was to ascertain how well Missouri extension council members understand council policies and responsibilities and to compare their understandings to selected characteristics; also to determine the relative importance and performance of selected council functions as determined by members and county agricultural agents.

METHOD OF RESEARCH: Data for the study were obtained through information forms presented at extension council meetings held by county agricultural agents in nineteen counties. Three hundred fifty-five members and nineteen agricultural agents completed the forms.

SUMMARY: Council members were given a test. The scores represented the dependent variable to which selected characteristics were compared. A score of twenty-two was possible. The mean score for the council members was 11.1. Sixty-five members, 18.3 percent, scored in the high level category of understanding (15 to 21 correct); 231, 65.1 percent, scored in the medium level category (8 to 14 correct); and 59, 16.6 percent, scored in the low level category (0 to 7 correct).

Council members in the 30 to 39 age group had an average score of 11.8; members in the 60 years of age or more group had an average score of 10.5; and members in the 20 to 29 and 40 to 49 age groups had average scores of 11.2 and 11.4.

Members who completed 13 years of more formal education had an average score of 12.3; those completing 9 to 12 years formal schooling had an average score of 11.2. An average score of 9.8 was made by members who completed 8 years or less of formal education.

Male council members operating farms of 325 to 424 and 425 to 524 acres had an average score of 13. Male members operating farms of 525 acres or more had an average score of 12.2. Those members who operated farms of 125 to 224 and 25 to 124 acres had average scores of 11.2 and 11, respectively.

Council members belonging to three or more farm organizations and those belonging to two farm organizations had average scores of 13 and 12.3. Average scores of 11.4 and 10.1 were made by members who belonged to one farm organization and those not belonging to any farm organization.

Average scores of 11.4 and 12 were made by members who belonged to two community or civic organizations and those belonging to three or more, respectively. Members belonging to one community or civic organization and those not belonging to any had average scores of 10.4 and 9.4.

Members holding, or having held, two offices and three or more offices in community or civic organizations, within the past five years, had average scores of 11.7 and 12.4. Average scores of 11.3 and 10.1 were made by members holding, or having held, one office in a community or civic organization and those not holding or having held any office within the past five years.

Members who participated in five or more extension activities and those who participated in four extension activities before being elected to councils had average scores of 12.4 and 12.2. Respondents who had participated in two and three extension activities before becoming members had average scores of 11.9 and 11.6; whereas those who participated in one extension activity before becoming members and those who had not participated in any extension activity had average scores of 10.1 and 9.4.

A correlation of .84 was obtained when the two rank orders of importance (judgment of members versus judgment of agents) of council functions were compared. The same comparison as to performance of council functions revealed a .41 correlation.

Microfilm \$2.85; Xerox \$9.90. 220 pages.

BIOLOGICAL AVAILABILITY OF NITROGEN IN CERTAIN CONDENSATION PRODUCTS OF THE REACTION OF UREA WITH FORMALDEHYDE

(L. C. Card No. Mic 60-6673)

Franklin Leslie Long, Ph.D.
The University of Florida, 1960

A series of laboratory and greenhouse experiments were conducted to assess the availability of the nitrogen in certain condensation products of the reaction of urea with formaldehyde. Special emphasis was placed on the availability of the water-insoluble nitrogen produced by the use of N-dure solution (59 percent formaldehyde and 26 percent urea) in the manufacture of mixed fertilizers. Lake-land fine sand of pH 5.6 was used in the study.

The rate of nitrogen applied in the various forms in the greenhouse pot tests with oats and millet generally was 100 pounds per acre. A water-insoluble nitrogen produced by N-dure was applied at the rate of 1,000 pounds per acre. The oats were planted first and clipped twice. Oat roots were then removed and the pots planted to millet. The oat clippings, oat roots, and millet were analyzed for nitrogen.

The nitrification studies were conducted in the laboratory in an incubator at 28°C. Nitrogen from the various sources was mixed with the soil at the rate of 100 parts per million. Moisture was maintained at 50 to 75 percent of field capacity. Nitrate nitrogen determinations were made at the end of 1, 2, 4, 8, and 12 weeks.

Oats, oat roots, and millet recovered a total of 71 percent of the applied nitrogen from a completely water-soluble mixture containing ammonia, ammonium nitrate, and ammonium sulfate under unlimed soil conditions, and 75 percent when the soil was limed with dolomite at the rate of 2,000 pounds per 2,000,000 pounds of soil. Of the net total nitrogen absorbed by the oats and millet about 50 percent was recovered by the oats in the first 42 days growth and about 33 percent in the next 31 days. Nitrification of this nitrogen source was greater in limed soil than in unlimed.

By comparison, approximately 44 percent total nitrogen recovery was obtained from a material having 46.3 percent of its nitrogen as water-insoluble produced by N-dure and the remainder water-soluble. The first oat clipping represented 65 percent of the total nitrogen absorbed by the crops from the 46.3 percent water-insoluble mixture as compared to 55 percent for the first clipping where the standard soluble source was used. However, the latter represented a higher total absorption from the soluble source by the first clipping.

The net total nitrogen recovered from a material containing only water-insoluble nitrogen produced by N-dure was only about 20 percent as compared to 75 percent recovery from the standard soluble source. The first oat clipping recovered about one-fifth as much nitrogen from this material as was recovered from the standard water-soluble source. The recovery by the millet was about three times that from the standard soluble source because of early depletion of soluble nitrogen in the latter source.

When water-insoluble nitrogen produced by N-dure was applied at the rate of 1,000 pounds per acre it gave a very favorable distribution of nitrogen uptake. Total yields were about twice those obtained from the standard soluble source, despite the fact that maximum yields from the soluble source appeared to occur when the nitrogen was applied at a rate somewhat less than 100 pounds per acre.

The total nitrogen recovery from three materials containing only water-insoluble nitrogen produced by N-dure increased with increasing urea to formaldehyde mole ratios.

The availability of the nitrogen contained in methylenediurea, dimethylenetriurea, and trimethylenetetraurea was quite high and appeared to be in the following decreasing order: methylenediurea, dimethylenetriurea, trimethylenetetraurea.

Microfilm \$2.75; Xerox \$6.00. 124 pages.

THE CONTRIBUTION OF SOIL NITROGEN TO THE NITROGEN REQUIREMENTS OF CROPS ON FLORIDA SOILS

(L. C. Card No. Mic 60-6674)

Mohammad Nawaz Malik, Ph.D.
The University of Florida, 1960

Studies were made of three methods of testing for soil nitrogen for the purpose of determining which of these methods is the most reliable for estimating the available nitrogen of a soil as a basis for recommendations for fertilizer nitrogen. A series of seven field and twelve greenhouse experiments were conducted in which varying rates of nitrogen were applied to oats, millet and rye. The nitrogen was applied as ammonium nitrate at rates equivalent to 0, 20, 40, 80 and 160 pounds of nitrogen per acre. Representative soil samples were obtained from each experiment and analyzed for total nitrogen and organic matter contents and for nitrate nitrogen produced during 14, 28, and 42 days of incubation. Forage yields and nitrogen absorption were determined for all crops.

Recovery of fertilizer nitrogen averaged about 50 percent for all rates of application. The recoveries by the millet crops were lower than recoveries by oats and rye. Recoveries of nitrogen applied to loams was 10 to 20 percent higher than for that applied to sands. The percent recovery increased with increases in the rate of mineralization of soil nitrogen.

Correlations of forage yields and recoveries of added nitrogen with the results of the various soil tests were determined.

The organic matter contents of soils were not significantly related to yields or uptake of nitrogen applied to crops growing thereon. Total soil nitrogen had a highly significant relationship to forage yield of oats and millet grown in the greenhouse. Nitrate production during two weeks of incubation was significantly related to yields obtained in all field and greenhouse experiments. The correlation coefficient values were higher for nitrate nitrogen than for total soil nitrogen. The soil "b" values, expressing the total amount of nitrogen made available to crops during the growing season, were highly significantly related to nitrate nitrogen produced during two weeks of incubation of the soils.

Regression equations for oats, millet and rye, employing the percent yield increases obtained from varying rates of nitrogen and the results of soil tests for total nitrogen and nitrate production were calculated.

The data from these studies were used to construct a modified Mitscherlich equation for use in predicting crop response to nitrogen fertilizer on the basis of a soil test for (1) total nitrogen and (2) nitrate production. The c factors, which express the efficiency of nitrogen utilization, were not significantly different for the various rates of nitrogen fertilization. Furthermore, the c values associated with the total soil nitrogen and nitrate production during two weeks of incubation were not significantly different. Either of the two soil tests could be used as a means of checking the potential of a soil to supply nitrogen to a crop. For a service laboratory, the total soil nitrogen test probably has the greatest potential, since incubation studies are rather time consuming.

Microfilm \$2.75; Xerox \$8.60. 188 pages.

AN INVESTIGATION OF THE SURFACE
CHEMISTRY OF THE MICAS

(L. C. Card No. Mic 60-6812)

Leslie Lee McDowell, Ph.D.
University of Missouri, 1960

Supervisor: C. E. Marshall

The interaction of the surfaces of seven micas with water, acids, and various salt solutions was investigated. From these experiments, information was obtained regarding the relative stability of these minerals in various chemical environments.

The primary reaction involved in the decomposition of these minerals in dilute acids and water was found to be cation exchange. The release of the interlayer cations, namely, sodium, potassium, and calcium was accomplished by the direct exchange of hydrogen from the acid or water. The order of resistance to decomposition of these minerals by hydrolysis was found to be rose muscovite > margarite > muscovite > phlogopite > biotite > lepidomelane. In these experiments the K^+-H^+ exchange process responsible for the decomposition of the minerals was found to be reversible. The initial rapid reaction or rate of decomposition noted in these experiments was followed by a rather slow reaction with time; the primary reaction observed was that of hydrogen exchanging for the interlayer cations. These factors strongly suggest that the initial reaction of the micas with very dilute ($<0.01\text{ N}$) acids and water is the formation at the mica surface of an insoluble $H-Al$ -silicate which temporarily prevents further reaction.

It was noted that the release of any ionic species during decomposition was not necessarily related to the chemical composition of the mineral. In addition, the differential release of ions by different reagents was clearly illustrated. These factors indicate that the selection of a suitable criterion for weathering or decomposition is extremely difficult.

The major part of this investigation was directed toward the surface ionization properties of the different micas. Quasi-thermodynamic measurements were made using metallic and clay membrane electrodes to determine the activity of H^+ , Na^+ , Ca^{++} , and Ag^+ in colloidal systems of H^+-Na^+ , H^+-Ca^{++} , and H^+-Ag^+ micas. These measurements gave information regarding the dissociation properties of the mineral surfaces and the bonding energies of these ions with respect to the surface of the different micas. In the neutralization of the H^+ -micas by various bases the primary factor is the direct exchange between the hydrogen ion and the metallic cation, when each cation is only partially dissociated. The simple mass-action equation often proposed for this process, namely, $H^+-colloid + K^+OH^- = K^+-colloid + H_2O$, is a gross oversimplification.

A thermodynamic approach through ion exchange reactions was also employed to study the surface ionization of these minerals. More specifically, cation exchange equilibria were determined, with the aid of radioisotopes, for these minerals using the same pairs of cations, namely, Li^+-Na^+ , $Li^+-NH_4^+$, Li^+-Rb^+ , Li^+-Cs^+ , $Ba^{++}-Sr^{++}$, and $Ba^{++}-Ca^{++}$. Exchange reaction "numbers" (selectivity numbers) were formulated using Donnan equilibria theory; these determinations were made when the solid (exchanger) phase was in equilibrium with a solution of low ionic

strength. Curves showing the variation in selectivity number with the ionic composition of the substrate illustrated the polyfunctional ionization of the micas with respect to the dissociation of monovalent and divalent cations. Microfilm \$4.55; Xerox \$16.20. 356 pages.

SOILS OF INDIAN MOUNDS IN NORTHEAST
IOWA AS SOIL GENESIS BENCHMARKS

(L. C. Card No. Mic 61-465)

Roger Bruce Parsons, Ph.D.
Iowa State University of Science and Technology, 1960

Supervisor: F. F. Riecken

The purpose of this investigation was to evaluate the degree of horizon development in seven prehistoric Indian mounds of known age in northeastern Iowa. Mound ages used were based on archaeological interpretations of radiocarbon dates obtained from charcoal interred in mounds of similar antiquity in the study area. Comparisons were made between the data obtained for the Indian mound soil profiles and two loess-derived Fayette profiles from the landscape adjacent to the mounds.

Field morphology of the soils was described in detail and the soils were sampled by horizons for the laboratory analyses as follows: (a) particle size distribution, (b) bulk density, (c) organic carbon, (d) pH, (e) total exchangeable bases, and (f) ratio of exchangeable calcium to magnesium. Thin sections of horizons which exhibited clay skins were compared with the A_2 horizons of the mound and Fayette soils. Several traverses were taken in the study area to establish the origin of the mound fill.

Morphologically, the mound profiles exhibited pronounced A_1 horizons, weak color and structural A_2 horizons, and incipient B horizons. However, horizon differentiation was not expressed to the same extent in all the mounds. Differences in profile development among the mounds were attributed to differences in mound age. The development of soil profiles in the mounds have been the most pronounced during the first 1000 years, have reached their greatest present horizon expression in a period of no more than 2500 years, and are similar in many respects to the Fayette soils which may have developed over a period of at least 14,000 years.

Microfilm \$2.75; Xerox \$7.20. 155 pages.

COMPARATIVE EVALUATION OF CLONES
AS TESTERS FOR YIELD, SPECIFIC
GRAVITY AND TUBER APPEARANCE
IN THE POTATO.

(L. C. Card No. Mic 61-472)

Lind Lee Sanford, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: E. S. Haber

A study was conducted to obtain estimates of general and specific combining ability variances from tests of 190 F_1 crosses and to evaluate six proposed tester clones for total yield, specific gravity, and tuber appearance.

Crosses were made between 45 diverse breeding lines and six clones selected as testers. The 190 crosses obtained were tested at Ithaca and Riverhead, New York, and at Clear Lake, Iowa, in a modified rectangular lattice design. Total yield data were taken at all locations. Specific gravity and tuber appearance measurements were recorded only at the Clear Lake location.

The calculation of line, tester, and line x tester variance components indicated that specific combining ability was relatively more important than general combining ability for yield. No substantial differences in the general combining ability of testers could be found in comparing their means. Significant interaction of specific combining ability with locations was observed in these data. Calculation of relative effects of each tester revealed that tester TL1859 was consistently high in all locations. It was concluded that its effect was largely non-additive. These yield data indicate that genetic improvement for this character would be difficult. A large number of testers would be required to select from the relatively small additive effects found.

General combining ability was found to be more important than specific combining ability in determining specific gravity. Tester B962-32 was significantly superior in mean performance to the two poorest testers. Testers B962-32, ND457-1, and B3131-8 gave the largest relative effects. Each of these clones is of high specific gravity. The three low specific gravity testers gave relatively small effects. It was therefore concluded that the phenotypic response of a parent for specific gravity would give fair prediction of its progenies performance. The data suggested that good general combining clones could be obtained through recurrent selection for additive effects.

General and specific combining ability were found to be of equal importance in determining tuber appearance. Tester ND457-1 was found superior as a general combiner. This tester and Katahdin gave the largest relative effects. These results agree with previous observations of the excellence of both clones as parents. It was felt that additive variation for tuber appearance is of sufficient magnitude to realize substantial genetic progress through development of clones of high general combining ability.

Comparisons of crosses between related, and unrelated lines and testers indicated that the relationship between testers and lines apparently has little or no effect on the resulting progeny. It was pointed out, however, that differences could have been averaged out by specific effects in such comparisons.

Microfilm \$2.75; Xerox \$3.80. 67 pages.

AGRICULTURE, ANIMAL CULTURE

THE EVALUATION OF CALORIE-PROTEIN
RATIOS IN SWINE NUTRITION

(L. C. Card No. Mic 60-6780)

Donald Edward Boenker, Ph.D.

University of Missouri, 1960

Supervisor: Leland F. Tribble

A total of 266 Duroc and Hampshire pigs were fed corn-soybean meal type rations containing three levels of protein, 13, 16 and 19 per cent, and three levels of metabolizable energy, approximately 1266, 1430 and 1592 Calories per pound (Titus 1955).

The influence of Calorie-protein ratios in practical swine rations on growth, feed efficiency, ration digestibility and backfat thickness were studied using a replicated 3 x 3 factorial, the only variables being energy and protein. The Calorie-protein ratio had no influence on growth, feed efficiency or ration digestibility. From weaning to 125 pounds, increasing the level of energy in the ration increased gains and feed efficiency of the pigs linearly ($P < .05$ and $P < .01$ respectively). The protein level did not influence gains or feed efficiency significantly. The protein level was reduced 3 per cent when the pigs reached 125 pounds. Pigs from 125 to 200 pounds gained faster as the energy level in the ration was increased. The increased growth response to increased energy level of the ration was linear ($P < .05$). Pigs fed 10 per cent protein rations gained slower ($P < .01$) than pigs fed 13 and 16 per cent rations. This response to the protein levels was linear ($P < .01$). Feed efficiency increased linearly ($P < .01$) with increasing levels of energy in the ration. Pigs fed the 10 per cent protein ration required more feed ($P < .05$) per 100 pounds of gain than pigs fed 13 and 16 per cent protein.

Calorie-protein ratios influenced the backfat thickness of swine. Widening of the Calorie-protein ratio at each protein level increased the deposition of backfat. There was a linear ($P < .01$) response to the energy and protein level of the ration on the backfat thickness, which increased with each increase in the energy, or decrease in protein level of the ration ($P < .01$).

The energy level did not influence the digestibility of the ration nutrients except, ether extract digestibility increased with the addition of fat to the ration. The addition of fiber (ground corn cobs) to the ration decreased the digestibility of the ration nutrients.

Experiments were conducted to study the effect of the addition of .2 per cent DL-lysine · HCl (95 per cent L-lysine), .1 per cent DL-methionine and .03 per cent DL-tryptophan to low protein (13 per cent) rations containing three levels of metabolizable energy. Pigs fed amino acid supplemented rations gained as fast or faster than pigs fed unsupplemented 13 or 16 per cent protein rations. Gains of pigs fed supplemented rations increased as the energy level of the ration increased. Feed efficiency increased with the addition of amino acids and increasing levels of energy in the ration.

A metabolism study was conducted to study the influence of the energy level of the ration on the digestibility and nitrogen retention of swine. A detailed description of

a metabolism cage for swine is given. The energy level of the ration did not influence the digestibility of the ration components except the digestibility of ether extract increased as the fat content of the ration increased. Increasing the level of fiber reduced the digestibility of the ration. Increasing the energy level of the ration decreased the amount of nitrogen stored, but not significantly. Determined metabolizable energy values for the rations were approximately 4 per cent higher than the calculated values for poultry (Titus 1955) and were in close agreement with values determined for the young pig (Diggs et al. 1959). Data are presented which suggests the value of 2000 digestible Calories per pound of TDN is a valid figure for the ration. Microfilm \$2.75; Xerox \$8.20. 176 pages.

GROWTH PATTERNS IN DWARF AND NORMAL HEREFORD CALVES

(L. C. Card No. Mic 61-438)

Kenly Paul Bovard, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisors: L. N. Hazel and J. W. Gowen

Growth patterns of 130 normal and 17 Snorter dwarf Hereford calves were studied to measure differences between dwarfs and normals, as well as differences between heterozygous and homozygous normal animals. Weight, several body measurements, and radiographic measures were included at ages from birth to 400 days.

Gross anatomical differences between dwarf and normal calves are largest in skeletal measures of longitudinal bone growth. There was complete separation between dwarfs and normals in external measures of loin width, wither height, body length, head length, tail length, cannon length and leg length. Dwarfs were much less abnormal for other skeletal measures such as head width, head depth, and cannon circumference. Until one year of age dwarfs were near normal in certain measures of body width and depth.

Curvilinear regression analyses of most body measures with age showed that such clean-carrier differences as may exist at birth are diminished by opposite, and therefore compensatory, differences in growth rates. The diagnostic value of some measures (e.g., leg length and loin width) which had shown large dwarf-normal differences apparently increases as calves grow older, since carriers are generally smaller at birth and subsequent growth in these measures is less than that of homozygous normals. This effect was larger in males than in females.

Within-calf regression analyses indicated that carrier bulls' daily weight gains were .18 pound per day less than those of homozygous normal bulls at birth, the difference being smaller at later ages. Weight gains of carrier heifer calves were not different from gains of homozygous normal females. Significant differences among calves' growth rates were found in each sex in measures of weight, loin width, cannon length, leg length and tail length.

For each animal of normal phenotype an estimate of its probability of being heterozygous was made using pedigree information and progeny-test results. This estimate was then used as the dependent variable in multiple regression

analyses of several phenotypic measures. Relatively large errors in predictions of individual genotype from body measures ($\pm .24$ for heifers, $\pm .18$ for bulls) seemed to limit the diagnostic value of this technique.

Analyses of weight, body measurements and radiographic measurements clearly indicate that, among the measures studied herein, the Snorter dwarf gene primarily affects longitudinal bone growth of the appendicular skeleton and vertebral development in the lumbar and coccygeal regions. Results suggest that on the basis of body proportions carrier calves did have some slight advantages at birth and shortly afterward. For most characteristics carriers were intermediate between homozygous normal and dwarf classes. This pattern was more distinct in males than in females. However, individual variation in size and proportions was so extensive that body measurements, when they are the sole source of information, can be of little practical use in distinguishing between clean and carrier animals.

Microfilm \$2.75; Xerox \$6.60. 138 pages.

RELATIONSHIPS BETWEEN LINEAR BODY MEASUREMENTS OF LIVE BEEF STEERS AND CARCASS MERIT

(L. C. Card No. Mic 61-93)

John Buric, Ph.D.

University of Illinois, 1960

Twenty-six linear body measurements were taken on 114 Hereford steers to evaluate the usefulness of body measurements taken on the live animal in predicting the weights of both wholesale and retail cuts.

The steers used in this study ranged in weight from 800 to 1215 pounds with an average slaughter weight of 989 pounds. The average slaughter grade was low choice and the range in slaughter grade was middle good to high choice.

All data were analyzed, on a within group basis, by means of zero order correlations, first and second order partial correlations, and multiple correlations. Zero order correlations were the intercorrelations of all data collected. The first and second order partial correlations, and the multiple correlations were between a selected group of body measurements and the weights of five wholesale cuts.

Analysis involving zero order correlations indicated that slaughter weight was the most valuable single factor in predicting the weight of the wholesale and retail cuts. The circumference of the heart girth, with a slight reduction in accuracy, can be used in lieu of slaughter weight.

First order partial correlations showed that, with slaughter weight held constant, the width of shoulders was the most important factor in predicting the combined weight of the round, rump, loin, rib, and chuck.

In the second order partial correlations, with slaughter weight and circumference of heart girth constant, it was shown that the length pins to hooks, width of thighs, and depth of chest were the important factors in predicting the weight of the round. Length pins to hooks and depth of chest were the most valuable factors in predicting the weight of the rump. In predicting the weight of the loin,

width shoulders, length pins to hooks, and width of hooks were the most significant. Width of thighs was the important factor in predicting the weight of the rib and the length of poll to muzzle was the second most important measurement. In predicting the weights of the chuck, the width of shoulders, width of thighs, and length of pins to hooks were more valuable, in that order. As was the case in the first order partial correlations, width of shoulder was the only measurement significantly correlated with the combined weight of the five wholesale cuts.

Using a team of predictors in multiple correlation analyses, it was shown that body measurements taken on the live animal can be used in predicting the weights of wholesale cuts. Sixty-six to 89 percent of the total variance in the weights of the five wholesale cuts and 93 percent of the total variations of the combined weight of five wholesale cuts was accounted for. By using a series of body measurements in conjunction with slaughter weight as a battery of predictors, the accuracy of prediction of the higher priced wholesale cuts (over using slaughter weight alone) was increased as follows: round, approximately 5 percent; rump, approximately 11 percent; loin, approximately 3.5 percent; and rib, approximately 3.6 percent. Only a slight increase was shown for predicting the weight of the chuck and combined weight of the five wholesale cuts. In addition, linear body measurement can be used, with approximately 3.5 to 7 percent reduction in accuracy (by excluding slaughter weight) to predict the weights of wholesale cuts.

From this study and that of other workers, it is concluded that linear body measurements can be used in predicting the weights of wholesale cuts. In addition, they would afford a more accurate description of the conformation of beef cattle and provide recorded objective values with which future progress can be compared.

Microfilm \$2.75; Xerox \$3.60. 62 pages.

THE EFFECTS OF FREQUENCY OF FEEDING ON PRODUCTION CHARACTERISTICS AND FEED UTILIZATION IN LACTATING DAIRY COWS

(L. C. Card No. Mic 60-6785)

John Roy Campbell, Ph.D.
University of Missouri, 1960

Supervisor: Dr. C. P. Merilan

This study was undertaken in an effort to gain information which might serve as a basis for selecting the optimum feeding intervals for desired milk production characteristics and efficiency of feed utilization.

A 3 X 3 Latin square design was used with three groups of seven Guernsey cows. Each group received three treatments - two, four or seven feedings daily. Feed utilization studies were conducted with each of these groups using the chromium oxide ratio technique for determining dry matter digestibility.

The effect of increased frequency of feeding on various production characteristics is reflected in trends of increasing pounds of milk production, pounds of 4 per cent fat-corrected-milk, per cent and pounds of butterfat,

pounds of solids-not-fat and pounds of total solids daily per cow. The increase in each production characteristic with increased feeding frequency was not significant at the 5 per cent level, although significance was approached for pounds of milk and pounds of 4 per cent fat-corrected-milk. Percentages of solids-not-fat and total solids were not markedly affected by frequency of feeding.

The production characteristics were comparable in the groups fed four and seven times daily, with the exception of a slight increase in the per cent butterfat in favor of feeding seven times daily.

Body weights taken at the end of each trial show that when fed two, four or seven times daily, the average body weight per cow was 1,166.2, 1,176.1 and 1,171.8 pounds, respectively. This indicates the frequency of feeding had no effect on body weight.

When fed two, four or seven times daily, the average total daily feed intakes were 38.9, 42.2 and 41.7 pounds per cow, respectively, thus indicating a trend of increasing feed intake with increased feeding frequency. These differences were not significant at the 5 per cent level.

The average 4 per cent fat-corrected-milk produced per pound of feed in the groups when fed two, four and seven times daily were 0.893, 0.947 and 0.963 pounds per cow, respectively. Although not significant at the 5 per cent level, the trend was increased pounds of 4 per cent fat-corrected-milk per pound of feed when fed four or seven times daily. Similarly, the per cent coefficient of efficiency showed an increasing trend with increased frequency of feeding with average values being 28.89, 30.52 and 30.57 per cent, respectively, when fed two, four or seven times daily.

A diurnal excretion pattern of fecal chromium oxide concentration showed the peaks of the excretion curves to be near 3:00 P.M. for the 2X and 4X groups and near 5:00 P.M. for the group fed 7X daily. The low points of excretion were near 3:00 A.M. for the 2X and 4X groups and near 5:00 A.M. for the group fed 7X daily. Sine curves plotted for each group showed decreasing amplitude in the daily excretion curve with increased feeding frequency.

When fed two, four or seven times daily, the average digestibility of dry matter was 51.59, 55.52 and 55.10 per cent, respectively. Although not significant at the 5 per cent level, these data indicate a higher dry matter digestibility with increased feeding intervals up to four times daily.

Microfilm \$2.75; Xerox \$7.80. 167 pages.

DIGESTION AND ABSORPTION OF CARBOHYDRATES DELIVERED DIRECTLY TO THE BOVINE OMASO-ABOMASUM

(L. C. Card No. Mic 61-452)

John Talmage Huber, Ph.D.
Iowa State University of Science and Technology, 1960

Supervisor: Norman L. Jacobson

This study consisted of two experiments. In experiment 1 each of eight carbohydrates (glucose, lactose, maltose, sucrose, amylose, amylopectin, Flojel (acid-treated corn starch) and tapioca) were delivered into the omaso-abomasal area of fasted animals of five age groups.

(Mean ages were 22, 50, 136, 227, and 600 days.) Usually four (but at times six) animals received each treatment in each age group. The carbohydrates were mixed with water; administration was by nipple pail at the three younger ages and by stomach tube via rumen fistula and reticulo-omasal orifice at the two older ages. Rate of administration was 2 g. per pound body weight except for amylose which was 1 g. Jugular blood samples were taken before feeding and 0.5, 1, 1.5, 2, 3, 5, and 8 hours thereafter.

Maximum increases in blood reducing sugar levels in mg. % after carbohydrate feeding at the five successive ages, from the youngest to the oldest, were glucose: 134, 130, 76, 82, 50; lactose: 148, 117, 36, 37, 14; maltose: 31, 72, 30, 34, 17. Maximum levels occurred 1 to 2 hours after feeding. Sucrose and starches did not cause any appreciable increase in blood reducing sugar at any ages. Mean changes (average change for the 5 hours subsequent to carbohydrate ingestion) in blood sugar were also calculated, and follow a pattern similar to maximum increases.

Glucose, maltose and sucrose usually caused diarrhea in less than 8 hours after carbohydrate ingestion. Lactose caused diarrhea in calves 12 weeks of age and older while no diarrhea resulted from ingestion of starch.

When an intravenous injection of glucose (0.3 g. per kg. body weight) preceded carbohydrate ingestion, blood sugar levels followed an exponential decrease until absorption of ingested carbohydrate (or its hydrolytic products) began. Approximate times of departure from the exponential (in minutes) for carbohydrates, were glucose and maltose: 15; lactose: 30; starches: 50. Blood sugar curves for sucrose were similar to controls (animals receiving injection only).

Blood sugar in calves increased moderately when starches were autoclaved (15 pounds per square inch for 30 minutes) or heated in water suspension.

Experiment 2 combined a digestibility and a blood reducing sugar study. Four calves, 3 months of age, received eight carbohydrate treatments (control, lactose, maltose, sucrose, amylose, amylopectin, Flojel and tapioca). Treatment consisted of adding 1.4 g. per pound body weight per day of carbohydrate to whole milk (fed at 3% of body weight by nipple pail). Pelleted alfalfa (steam compressed with no added binding agents) and fresh water were fed to animals ad libitum. Each calf received each ration for 10 days. The first 5 days were spent in pens and the last 5 days in digestion stalls. In the latter, feces were accumulated for 12 hours, weighed, and a weighted sample (10%) was stored for analysis. During the last 24 hours in stalls, feces samples (25 g.) were taken at 2 hour intervals. Blood samples, also taken during this period, were made just prior to the morning feeding, and at 1, 2, 3, 4, 6 and 8 hours thereafter.

Mean digestion coefficients for the lactose, maltose, sucrose and starches (mean for all starches) were 94, 97, 58 and 83%, respectively. In feces from sucrose and starch diets, considerable carbohydrate was monosaccharide (68 and 25%, respectively), indicating microbial degradation in the lower tract.

Maximum increases in blood sugar in mg. % after ingestion of the treatments were control: 19; lactose: 37; maltose: 46; sucrose: 13; starches (mean): 24.

Carbohydrate in fecal dry matter in diurnal samples showed two distinct peaks. The peaks for lactose, maltose, sucrose and starch occurred at about 9, 8, 6 and 11 hours after feeding, respectively.

Microfilm \$2.75; Xerox \$6.40. 134 pages.

EFFECT OF PROTEIN SOURCE AND AMINO ACID SUPPLEMENTATION ON INTESTINAL MICROFLORA AND PLASMA AMINO ACIDS OF THE CHICK

(L. C. Card No. Mic 61-463)

William James Owings, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Dr. S. L. Balloun

The addition of arginine to purified diets based on zein, gelatin-casein, Drackett protein or casein-zein did not result in improved chick growth. Chick weights were significantly improved on a casein diet, in which the arginine level was increased from 1.2 to 1.8 percent.

Column chromatography was used to quantitatively separate the free amino acids of the blood plasma of the chick. Increasing dietary arginine on a casein diet increased the free arginine of the blood only a few micrograms per milliliter, and also increased lysine, proline and serine while decreasing threonine, glutamic acid, alanine, valine, methionine, isoleucine, leucine, tyrosine, phenylalanine, histidine and ammonia. Aspartic acid and glycine remained at essentially the same concentration. The addition of lysine to a casein and casein-zein diet increased the free lysine blood plasma level and decreased the plasma arginine concentration. Arginine additions to a casein-zein diet resulted in an increase in both free arginine and lysine in the blood plasma.

The improved weight gains of chicks on the casein diets was thought to be due to an improved amino acid balance in the blood in which some of the excessive essential and nonessential amino acids available in casein were not absorbed to the extent that they were on the low-arginine diets.

Microorganisms from the anterior portion of the small intestine of the chick were studied, using a plate count technique with selective media. The addition of arginine to casein, zein, gelatin-casein, Drackett protein and casein-zein diets increased the coliform, lactobacilli, total aerobes, total anaerobes, staphylococci, streptococci and mold and yeast counts, with the exception of mold and yeast counts on a zein diet which were not determined. The addition of lysine alone or in combination with arginine to casein and casein-zein diets also increased the microflora counts of the anterior portion of the intestinal tract.

The different purified protein sources influenced the microflora counts in the intestine of young chicks very little, regardless of the influence of the diet on chick growth.

Microfilm \$2.75; Xerox \$5.60. 112 pages.

EFFECTS OF VARIOUS COMBINATIONS OF ENVIRONMENTAL TEMPERATURE AND HUMIDITY ON THE COMPOSITION OF MILK AND MILK FAT OF THE DAIRY COW

(L. C. Card No. Mic 60-6819)

Curtis Weldon Richardson, Ph.D.
University of Missouri, 1960

Supervisor: Dr. Harold D. Johnson

Studies were undertaken in the Missouri Climatic Laboratory in an effort to gain more specific information on the effects of various combinations of environmental temperature and humidity on the yield and composition of milk. Lactating Holstein cows were exposed continuously for two-week periods to various controlled climatic treatment conditions. Each treatment condition was followed by a two-week adjustment period at 65°F.-50% R.H.

The daily milk yield of most of the cows in this study decreased at environmental temperatures of 80°F. and above. The severity of decline in milk yield appeared to be intensified by increasing the relative humidity at each temperature condition. When the humidity was increased to 40 or 50 percent at a temperature of 90°F., milk yield decreased more than fifty percent in many individuals. Very definite individual differences were observed in the ability of the cows in this study to maintain high milk production at high temperature and humidity levels.

Butterfat production paralleled the declines observed in milk yield at the high temperature and humidity levels. The greatest depressions in butterfat production occurred at the 90°F.-40% R.H. and the 90°F.-50% R.H. conditions.

Total solids content of the milk decreased at 80° or 90°F. regardless of the level of humidity. The most significant declines in percent total solids occurred at the 50 and 80 percent humidity levels with a mean temperature of 80°F.

The percentage of solids-not-fat in milk decreased in a similar manner as total solids. A depression was observed at all treatment conditions in this investigation. The 80°F.-80% R.H. and the 90°F.-50% R.H. conditions had the most significant depressing effects upon the production of solids-not-fat constituents of milk.

Total nitrogen in milk decreased at both 80° and 90°F. with all levels of humidity. Greater declines were observed at 90°F. in combination with either 40 or 50 percent humidity. There appeared to be an inverse relationship between total nitrogen and non-protein nitrogen. The most significant increases in non-protein nitrogen paralleled the most significant decreases in total nitrogen.

The percentage of lactose in the milk varied only slightly at the different environmental conditions. There were slight declines noticeable at 90°F. in combination with either 40 or 50 percent relative humidity.

A short study was conducted to compare the effects of chopped hay and finely ground pelleted hay on the butterfat and total solids content of the milk. The results indicated that cows will not maintain as high a level of butterfat or total solids when fed a ration of finely ground pelleted hay as when fed chopped hay.

Gas chromatographic analysis revealed that high environmental temperatures and various levels of humidity caused marked differences in the fatty acid composition of milk fat from cows held continuously at various controlled

conditions. The short-chain fatty acids ($C_6 - C_{12}$) were lower at the treatment conditions (85°F.-70% R.H., 90°F.-25% R.H., 95°F.-25% R.H.) than at the control (65°F.-50% R.H.). There was no significant difference in the level of myristic acid (C_{14}) at the treatment and control conditions. Palmitic acid (C_{16}) increased at the higher temperature levels. Oleic acid ($C_{18} \Delta^9$) decreased while stearic acid (C_{18}) increased at the treatment conditions. It was concluded that any combination of high environmental temperature and humidity which results in a rectal temperature of 103° to 105°F. may cause definite changes in the characteristics of the milk fat.

Microfilm \$2.75; Xerox \$8.40. 181 pages.

THE PHOSPHORUS REQUIREMENT OF PIGS FROM TWO TO SEVEN WEEKS OF AGE

(L. C. Card No. Mic 60-6683)

Joseph Marcel Vandepopuliere, Ph.D.
The University of Florida, 1960

Pigs weaned at approximately 14 days of age were used in a series of 8 experiments to determine the phosphorus requirement of pigs from 2 to 7 weeks of age.

Semi-synthetic and fortified corn-soybean oil meal rations containing different levels of phosphorus were formulated which were suitable for use in determining the phosphorus requirement of the early weaned pig.

Deficiency symptoms were observed when 2- to 7-week-old pigs were fed the semi-synthetic ration containing .36 percent phosphorus. When the phosphorus level was increased to .40 percent deficiency symptoms were not observed until the pig weighed approximately 100 pounds. This is in agreement with the deficiency symptoms observed on the corn-soybean oil meal rations containing .40 percent phosphorus. Since deficiency symptoms were observed on each of the 3 Ca:P ratios fed it would appear that these were true phosphorus deficiency symptoms.

The major problem in developing the surgical technique was the administration of the anesthetic. It was observed that when procaine was injected epidurally severe nervous reactions were produced frequently resulting in loss of equilibrium, paralysis of the hind quarters or death. When procaine was injected intramuscularly around the fibula these adverse side reactions were not produced and the surgical removal of the fibula was done with a minimum amount of pain. The section of the fibula removed by surgery was an excellent representative bone sample for bone ash and X-ray analyses. Observations on pigs at 35 and 155 days of age indicated that the removal of the fibula when the pig was 7 weeks old was not detrimental with regard to gain or locomotion.

In studying radiographs it is apparent that there is a difference in the background density of the developed films. Since it is not possible to standardize the exposure and development time it is necessary to use an internal standard. In this study an ivory echelon was used in each exposure and the density of the removed bone was compared directly to the ivory echelon. The technique used to correct for the tissue surrounding the intact fibula was not entirely successful since the *in vivo* fibula had greater density than the removed fibula. Further modifications of

this technique would not only improve the value for its use with early weaned pigs but it would provide a useful tool in studying bone calcification of larger animals such as the 200-pound pig.

Bone ash was used in this study as a control criterion for comparison with the *in vivo* and removed bone density. The statistical evaluation of the responses of the various criteria when young pigs were fed rations with various phosphorus levels indicate that bone ash and bone density of the removed bone were comparable followed by the *in vivo* bone density. This is in agreement with work by Facto et al. (1956) who reported a positive relationship with bone ash and bone density. Similar results were observed with the 155-day-old pig with the exception of the *in vivo* fibula density which did not exhibit statistically significant differences among treatments.

The results of this study show that the phosphorus requirement of pigs from 2 to 7 weeks of age is .44 percent of the ration when a fortified corn-soybean oil meal ration is fed with a Ca:P ratio of 0.9:1.

Microfilm \$2.75; Xerox \$7.20. 152 pages.

OVINE RATION EVALUATION SYSTEMS AS INFLUENCED BY RATION COMPOSITION

(L. C. Card No. Mic 60-6827)

Thomas Wayne White, Ph.D.
University of Missouri, 1960

Supervisor: W. H. Pfander

Seventy-six lambs were used in two trials, in which nutrient digestibility, nitrogen retention, volatile fatty acid content of the rumen and gains were used as criteria to compare energy evaluation systems in rations containing cellulose and nitrogen levels.

A 3 x 3 factorial design was used in Trial I with 13.87, 16.11 and 20.42 per cent cellulose levels being combined with 1.78, 2.12, and 2.45 per cent nitrogen levels to form the rations. In Trials II a 2 x 2 factorial design was used with 13.73 and 19.73 per cent cellulose levels being combined with 1.98 and 2.29 per cent nitrogen levels to form the rations.

A high correlation was found between dry matter and energy digested ($r = +0.87$) and between organic matter and energy digested ($r = +0.88$). Regression equations for estimating energy digested (Y) from dry matter (X_1) or organic matter digested (X_2) are $Y = -243.7 + 5.14 X_1$ and $Y = -284.4 + 5.37 X_2$, respectively.

Total digestible nutrients, digestible energy and "metabolizable energy" were each correlated with average daily gain ($r = +0.54$, $+0.61$ and $+0.44$, respectively).

Cellulose digestibility was significantly increased by increasing the cellulose level of the rations. Increasing the cellulose level decreased the nitrogen-free extract digestibility and as a result dry matter, organic matter, and energy digestibilities were decreased.

Total nitrogen retention was not influenced by nitrogen or cellulose level. A gram of urinary nitrogen was equivalent to 11.2 kilocalories in Trial I and 13.6 or 12.1 kilocalories from lambs fed 1.98 and 2.29 per cent nitrogen ration in Trial II. Daily urinary nitrogen excretion in-

creased in both trials when the per cent nitrogen in the ration was increased. Urinary energy excretion was increased by increasing the nitrogen level only in Trial I.

The acetic acid content of the rumen was significantly increased by increasing the cellulose level from 13.87 or 16.11 to 20.42 per cent in Trial I. Other volatile fatty acid differences were not significant.

A positive correlation ($r = +0.53$) was found between gains during the feeding period and nitrogen-free extract digestibility during the digestion phase of Trial II. In contrast, cellulose digestibility was negatively correlated ($r = -0.49$) with gains.

There was a trend for average daily gains to increase with increases in cellulose content of the ration in Trial I. In Trial II, the low nitrogen or low cellulose rations were superior to other rations in stimulating average daily gain. Clean wool production per square centimeter of skin surface was higher when lambs were fed the 1.98 per cent nitrogen and 13.73 per cent cellulose ration than when they were fed other rations.

Microfilm \$2.75; Xerox \$8.60. 188 pages.

AGRICULTURE, PLANT CULTURE

MICROBIOLOGICAL AND CHEMICAL TECHNIQUES FOR THE ASSAY OF AVAILABLE SOIL NITROGEN

(L. C. Card No. Mic 61-29)

Fred C. Boswell, Ph.D.
The Pennsylvania State University, 1960

Microbiological and chemical techniques for assaying available soil nitrogen were evaluated using thirty soil samples selected from four different sites within the United States. Nitrifying capacity of these soils, as measured by incubation under controlled conditions, was used as the standard for comparison.

A microbiological technique was devised using a strain of the proteinaceous bacterium *Pseudomonas aeruginosa*. Production of a pigment by this organism during growth in a medium in which soil served as the nitrogen source was used as the criterion for measuring available soil nitrogen. With this technique a highly significant negative correlation was obtained between pigment production and nitrifying capacity for the thirty soil samples studied. Also, the assay results could be obtained in a 4-day period instead of the 2-6 week period required for the incubation nitrifying capacity technique.

It is difficult to explain the highly significant negative correlations obtained by the method developed, since the results are directly opposite to the original hypothesis. Possible explanations are that in soils with high organic matter, and therefore high nitrifying capacity, the pigment is (a) not produced (b) converted to another type pigment (c) complexed with soil particles and/or organic matter in some unknown manner, or (d) soils high in organic matter may contain larger numbers of zymogenous flora, such as *Actinomyces*, as compared to soils low in organic matter. The zymogenous flora may have produced antibiotics which

either reduced the growth of *Pseudomonas aeruginosa* or prevented pigment formation.

The microbiological technique was compared with the chemical methods of Truog and of Purvis. In the Truog procedure ammonia is distilled from soils in the presence of alkaline permanganate. The Purvis method involves hydrolysis and mild oxidation with dilute sulfuric acid followed by ammonium ion determination by Nesslerization. Both chemical methods yielded highly significant correlations with nitrifying capacity. The correlation between the two chemical methods also was highly significant. The Truog method and the microbiological technique exhibited a negative correlation of high significance while the correlation between the Purvis method and the microbiological technique was not significant.

Microfilm \$2.75; Xerox \$4.60. 87 pages.

THE RELATIONSHIP BETWEEN MOISTURE
STRESS AND THE UPTAKE AND
TRANSLOCATION OF PHOSPHORUS
BY PLANTS

(L. C. Card No. Mic 60-6800)

Joe Nelson Corgan, Ph.D.
University of Missouri, 1960

Supervisor: A. D. Hibbard

The effect of drought during different periods of the year on the phosphorus content of apple seedlings was determined for plants grown over a period of two years. There was no effect of drought at any period of the year on the percentage phosphorus in the leaves.

Soil of varying calcium, potassium, and sodium saturation was used for determination of the interaction between cationic composition of the soil, moisture stress, and the uptake of phosphorus. This interaction was highly significant, and the primary effect of moisture stress in reducing uptake of phosphorus to the plant tops was very large.

Three week old tomato plants were grown for three weeks in vermiculite on Hoagland's solution, then permitted to absorb radioactive phosphorus for one-half hour under varying conditions of moisture stress and relative humidity. Either of these factors which reduced transpiration also reduced uptake of phosphorus to the plant tops. Moisture stress was imposed by addition of mannitol to the solution.

Experiments were conducted to determine the effect of moisture stress on the capacity of eight day old bean plants for absorption and translocation of phosphorus. Mannitol concentrations up to 0.5 molar had no effect on rate of uptake of phosphorus from solution containing up to 30 ppm phosphorus. Translocation to the tops was determined by the ratio of P^{32} in tops: P^{32} in roots after the plants had been absorbing four hours. In nutrient solution with high concentration of phosphorus there was a definite relationship between transpiration and translocation of phosphorus to the tops, but in a soil suspension where the concentration of phosphorus was limiting this relationship was not clearly defined.

Microfilm \$2.75; Xerox \$6.40. 132 pages.

PART I. BETA AND GAMMA RADIATION
STUDIES IN *PISUM SATIVUM*.

PART II. THE INHERITANCE OF *FUSARIUM*
ROOT-ROT, *FUSARIUM SOLANI PISI*,
RESISTANCE IN *PISUM SATIVUM*.

(L. C. Card No. Mic 60-6960)

Dean Edgar Knavel, Ph.D.
Michigan State University, 1959

Major Professor: J. Clark Ballard

Beta and gamma radiation sources were evaluated for producing mutations and resistance to *Fusarium* root-rot, *Fusarium solani* f. *pisi*, in peas. Dry pea seeds and seeds soaked in either water, solutions of colchicine, Endothal, or uranyl nitrate of the variety Early Perfection were irradiated. The dry seeds were exposed to radiation dosages of 7,500r and 15,000r of the gamma source and 20,000 rep and 40,000 rep of the beta source. The soaked seeds were exposed to dosages of 1,500r, 3,000r, 10,000 rep, and 20,000 rep.

Gamma irradiation was more effective than beta irradiation of dry seeds for reducing germination and increasing the numbers of plants showing dwarfing, leaf distortion, and leaf-variegations in the R_1 . Five per cent of the seeds germinated and all of the surviving R_1 plants showed visible changes at a dosage level of 15,000r. In comparison, 16 per cent of the seeds germinated, and only 58 per cent of the R_1 plants showed similar visible changes at 40,000 rep.

Soaking seeds in the chemical solutions prior to either radiation source did not cause any appreciable increase in the variability in the R_2 plants. However, soaking seeds in water prior to gamma radiation was more effective than gamma and beta irradiation of dry and chemically soaked seeds with regards to the numbers of abnormal plants in the R_2 . Abnormal R_2 plants were characterized by chlorophyll deficiencies, sterility, lateness, earliness, tallness, dwarfness, and plants that branched at the base.

Two gamma radiation-induced tall plants were studied in detail. Plants from irradiated seeds in the R_3 generation flowered as early as Early Perfection plants from non-irradiated seeds during long days, however, when the R_4 was grown under short day lengths and low light intensities, flowering was delayed approximately one month longer than the non-irradiated Early Perfection plants. Non-irradiated plants flowered in 32-36 days after seeding under long days.

All R_3 plants grown from irradiated seed and tested for *Fusarium* root-rot resistance were found susceptible to the disease.

The variety Early Perfection was crossed to a *Fusarium* root-rot resistant Foreign pea introduction, 140165, to study the mode of inheritance for resistance to *Fusarium* root-rot, to determine if resistance was associated with seed-shape and seed coat color, and if resistant Perfection-type plants could be obtained.

The *Fusarium* root-rot test of the F_3 populations, Early Perfection X 140165 and 140165 X Early Perfection, indicated that resistance to *Fusarium* root-rot was dominant. The curve showing the distribution of the F_3 progeny was not normal. F_3 segregates from wrinkled seeds and seeds with transparent coats, which are characteristic of Early Perfection, were similar in resistance as color coated and

smooth seeds. The latter seed-types are representative of the resistant parent, 140165. The short internode Perfection-type progeny of the F₃ populations were slightly more resistant than the long internode 140165-type.

Microfilm \$2.75; Xerox \$4.80. 92 pages.

QUANTITATIVE RELATIONSHIP OF SOIL MOTTling TO NATURAL SOIL DRAINAGE PROFILES (AERATION STATUS)

(L. C. Card No. Mic 61-48)

Frank Glade Loughry, Ph.D.
The Pennsylvania State University, 1960

This research was undertaken to provide more quantitative measures of soil mottling and to improve its use as an indicator of natural soil drainage. In humid areas of podzolic soils the presence of mottling in a soil horizon is commonly accepted as the most easily observed sign of poor drainage due to seasonal saturation. Application of standard descriptive terms for abundance, size, and contrast of mottles and the significance attached to mottling has been a matter for the judgment of the individual soil scientist.

A method was developed to count abundance of each color of mottle using a perforated plastic grid having one-hundred holes two millimeters in diameter spaced in a diagonal arrangement in an area of 2.5 square inches. A formula

$$\frac{\text{Abundance}}{100} \times \text{Size} \times \text{Contrast} = \text{Mottling Factor}$$

is suggested for expressing the net visual impression of mottling as a single value which can be used in comparison of one horizon with another. In this formula Abundance is expressed in percent; Size is expressed as a code number with numbers 1, 2, and 3 being equivalent respectively, to sizes less than 5 mm., 5 to 15 mm., and greater than 15 mm.; and Contrast is expressed as a summation of the differences in Munsell units of hue, value, and chroma between the mottles and the matrix or between mottles.

Relation of mottling to various soil factors was shown by field tests on representative soil profiles. Tests included extraction of ferrous iron, pH, bulk density, and root distribution.

Mottling counts with the perforated grid showed some variance, but for most horizons the replicates were not significantly different when measured against total variance including that between horizons.

Most mottled soils showed at least two colors of mottles contrasting with the matrix. One color was paler than the matrix and the other had more chroma and, usually, redder or browner hue. Mottling was definitely related to structural aggregates. Gray coatings on peds were very common.

In the soils used, ferrous iron extracted did not correlate with the mottling factor. Repeated pH tests showed seasonal variation with pH's rising during a wet summer and falling in a dryer summer.

Bulk density did not correlate with mottling. Pore size distribution tests helped to explain the lack of correlation. Root distribution was negatively correlated with bulk

density for four of the five soils where roots were measured. Root distribution did not consistently correlate with the mottling factor.

Some soil horizons which were not considered poorly aerated showed a little mottling. If mottling factors below 0.25 were disregarded in determining depth to significantly mottled horizons there was good agreement with commonly recognized ranges of the drainage classes.

Size of mottle appeared to be less significant than abundance or contrast. Abundance is very important as an expression of total change. Contrast is indicative of the nature of change.

Mottling counts and descriptions made by several soil scientists as a test of the method outlined demonstrated a need for the improved techniques and care in their use. Measurements and forms developed in this study can be the basis of training.

Microfilm \$3.75; Xerox \$13.30. 292 pages.

AGRICULTURE, PLANT PATHOLOGY

ETIOLOGY AND CONTROL OF WALNUT ANTHRACNOSE

(L. C. Card No. Mic 61-411)

Frederick Hamer Berry, Ph.D.
University of Maryland, 1960

Supervisor: Dr. Carroll E. Cox

Walnut anthracnose is caused by a fungus, *Gnomonia leptostyla* (Fr.) Ces. and de N., which attacks various walnut species and causes their premature defoliation.

The nature of the fungus causing walnut anthracnose, its host relations, and methods of controlling it were studied.

The fungus attacks the leaves, nuts, and occasionally the shoots of the current season's growth. On the leaflets the lesions are from pinpoint size to 8 millimeters in diameter. Premature defoliation generally follows infection but in some instances infected leaves remain attached to the tree for most of the season.

The anthracnose fungus overwinters primarily in fallen walnut leaves infected the previous season. Ascospores discharged from perithecia in the overwintered leaves and carried by wind currents to susceptible walnut foliage cause the primary infections in the spring. Ascospores, as well as the conidia, which cause secondary infection, are disseminated only during rainy weather.

Artificial inoculation of black walnut seedlings with a suspension of spores from black walnut leaves indicated that under controlled conditions about 14-16 days elapse from the time of inoculation until the first necrotic lesions are visible. Lack of infection of Persian walnut seedlings with a spore suspension from black walnut leaves indicated the possibility that a separate strain of the fungus attacks Persian walnuts.

Walnut anthracnose was most destructive on eastern black walnut, *Juglans nigra* L. Over 40 different varieties showed considerable variation in susceptibility to

anthracnose. However, when climatic conditions were favorable for anthracnose development even the less susceptible varieties were severely infected and defoliated.

In protective spraying experiments over a 5-year period, zineb (Dithane Z-78) gave consistent and effective control of anthracnose. It gave adequate control of the disease in 1958 when anthracnose was most severe. Bordeaux mixture, phenylmercury triethanol ammonium lactate (Puratized Agricultural Spray), maneb (Dithane M-22), and dodine (Cyprex), tested less extensively than zineb, apparently controlled anthracnose satisfactorily. Other fungicides tested did not give satisfactory control under the climatic conditions encountered. None of the fungicides injured walnut foliage.

In other spraying experiments, dormant eradicant spray reduced, but did not eliminate the need for later protective sprays.

In experiments in which certain spray applications were omitted, 4 applications of a protective fungicide were necessary to control anthracnose. To protect the trees from primary infection the first spray had to be applied when the leaves on most varieties were half to three-fourths mature size. Omission of the first spray application resulted in a great increase in the severity of infection and defoliation.

Kernel percentage and specific gravity of the nuts were used as measures of filling in order to determine the effect of anthracnose on the filling of the nuts. Nut samples from black walnut trees of the Ohio variety showing various degrees of premature defoliation showed that as defoliation increased, specific gravity and kernel percentage of the nuts decreased. Nuts from trees on which the disease was controlled contained plump, light-colored kernels. On other trees as defoliation increased the percentage of nuts having dark, unattractive, shriveled kernels increased. In another orchard, however, there was no significant difference in the specific gravity or kernel percentage of nut samples from black walnut trees of the Stabler variety. Apparently this variety bore such light crops of nuts during the period the orchard was under study that premature

defoliation caused by the anthracnose fungus did not affect quality or filling of nuts.

Microfilm \$2.75; Xerox \$4.00. 73 pages.

A STEM ROTTING DISEASE OF DRACAENA SANDERIANA CAUSED BY AN UNDESCRIBED STRAIN OF ASPERGILLUS NIGER

(L. C. Card No. Mic 60-6678)

Rashad Mustafa Natour, Ph.D.
The University of Florida, 1960

The occurrence of a serious disease on *Dracaena sanderiana* in Florida has been frequently observed. It occurs in most nurseries where the plant is grown, and may cause a total loss of the planting. Infection occurs through the basal end of tip cuttings before or during rooting. Infected plants wilt and the leaves turn yellow progressively from the base upward. The lower part of the stem becomes darkened, water-soaked and rotted. Dark chocolate-brown masses of fungus spores cover the rotted areas. The disease is caused by a variety of *Aspergillus niger* V. Tiegh. Cultural and morphological characteristics, cross inoculation and host range studies indicate the fungus is a new variety of *A. niger*. The name *Aspergillus niger* V. Tiegh. var. *floridanus* var. nov. is proposed. The fungus is soil borne and can survive in the soil for long periods of time even under adverse conditions. It is a wound parasite and attacks only the stems of *Dracaena* for which it has a high specificity. The fungus is believed to produce pectic enzymes, especially protopectinase, which cause a maceration of plant tissue. Histological sections showed this maceration to occur well beyond the growth of the fungus in the plant tissue. Rootone, Fermate and Thylate used as dust at the basal end of tip cuttings provided complete protection against fungus invasion.

Microfilm \$2.75; Xerox \$4.00. 74 pages.

ANATOMY

A STUDY OF CELL DIVISION IN CHICK EMBRYONIC GANGLIA

(L. C. Card No. Mic 61-240)

Robert Doyle Yates, Ph.D.
University of Alabama, 1960

This research was undertaken to study cell division in embryonic chick spinal ganglia giving particular reference to the nerve cell precursors or neuroblasts. Cell division was evaluated by determining the proliferation rate (ratio of dividing to nondividing ganglionic cells of all types) and the number, per cent and total period of development in which neuroblasts divided. Neuroblasts were identified on the basis of cytoplasmic ribonucleic acid, nuclear and

nucleolar appearance during the intermitotic stages and by cytoplasmic ribonucleic acid during cell division. The identification of cytoplasmic ribonucleic acid, which is the principal component of Nissl substance, was verified by treatment with ribonuclease.

The proliferation rate among the various ganglionic cells and the number, per cent and time of cessation of division of neuroblasts were established in normal brachial and extrabrachial ganglia at four through twelve days incubation. In addition, the proliferation rate and the time of cessation of division of neuroblasts in various cranial sensory and autonomic ganglia were determined between three and ten days incubation.

An experimental approach involved grafting isolated areas of the chick blastoderm in stages ranging from the

head process through the head fold to the chorio-allantoic membrane or coelom of older host embryos. The spinal ganglia developing in such grafts were analyzed to determine if the modified conditions produced an alteration from normal in the proliferation rate or the number, per cent and total period of development in which division occurred in neuroblasts.

The data indicated that the proliferation rate was inherent in the nervous tissue itself. Thus, in spite of the wide variations in the extrinsic areas innervated, no significant variation was found in the proliferation rate of brachial and extrabrachial level spinal ganglia, sensory cranial and ciliary ganglia or the spinal ganglia developing in the grafted blastoderm areas at comparable days of development.

The time of cessation of division of neuroblasts also seemed to represent a feature inherent in the nervous tissue. The cessation occurred in practically all neuroblasts by the end of the sixth day in all normal sensory, cranial sensory and ciliary ganglia studied. The time of cessation of division of neuroblasts in the ganglia of the grafted blastoderm areas also occurred by the end of the sixth day. While a variation in the number of dividing

neuroblasts occurred in the spinal ganglia under normal and experimental conditions, little variation in the per cent was observed.

Although the proliferation rate and the time of cessation of division of neuroblasts was believed to be due to some inherent tissue factor, the peripheral mass innervated did appear to affect cell division indirectly. If the peripheral mass was small, then apparently what were excessive ganglionic nerve cells already differentiated underwent degeneration so that a certain balance was maintained. With this degeneration there were not only fewer cells in the ganglion but also fewer divisions, and consequently the proliferation rate remained constant. This was observed to be the case in extrabrachial level spinal ganglia which innervated minor areas and also in the ganglia of the grafted blastoderm areas where minimal tissue growth occurred. In such extrabrachial ganglia and ganglia of small grafts, there was a smaller number of ganglionic cells with fewer cell divisions among them and greater nerve cell degeneration than in the brachial level ganglia and ganglia of grafts that showed maximal tissue growth. Microfilm \$2.75; Xerox \$3.00. 58 pages.

ANTHROPOLOGY

ZEN BUDDHISM, "THOUGHT REFORM"
(BRAINWASHING) AND VARIOUS
PSYCHOTHERAPIES: A THEORETICAL
STUDY IN INDUCED REGRESSION
AND CULTURAL VALUES.

(L. C. Card No. Mic 61-498)

Ernest Becker, Ph.D.
Syracuse University, 1960

This is a theoretical study of Zen Buddhism as a coercive, regressive method which seeks conversion or "re-birth." Material was gathered from documentary sources--no original research was carried out. The central hypothesis of this study is the basic identity of the Zen aim with that of brainwashing, or any extremely "supportive" type of therapy. A subsidiary hypothesis is the central role of the trance in Zen--a crucial aspect of the Zen conversion. Possibilities for verification of the hypothesis of this study can come especially from research on Morita therapy--a derivative of Zen; and from study of the workings of Zen itself. Materials on "brainwashing" are not treated critically, but are presented as background. Psychotherapy is examined mainly in order to underscore the critical role of superego manipulations in any therapeutic reform.

Part I is a survey of concepts of stress and regressive adaptation that figure in the study. Part II examines in turn: Brainwashing, Psychotherapy and Zen. Zen is treated in greatest detail and length, with an examination of first-hand accounts of disciples who have undergone the discipline and been converted. Detailed psychotherapeutic observations on Zen are also presented, as well as

strictly anthropological observations on the history of Zen in China and Japan--stressing the coarse, magical background from which it derived. Part III deals with the values of Zen, the messianic credo of becoming of the Cosmic Will and the consequent espousal of any means calculated to subjugate the "conscious," "fractured," and cerebrating individual to the "unconscious" source of spiritual power. Part III presents also a discussion of the invasion of therapy by Zen mysticism, a brief overview of Japanese psychotherapy, and a concluding discussion of the general values underlying psychotherapy. The anti-theoretical nature--to traditional Western values--of a credo that espouses Universal Becoming at the expense of individuation--is stressed.

Microfilm \$5.05; Xerox \$18.00. 396 pages.

ROCK VILLAGE, AN ETHNOHISTORICAL
APPROACH TO HIDATSA ARCHAEOLOGY.

(L. C. Card No. Mic 60-5091)

Donald Dean Hartle, Ph.D.
Columbia University, 1960

This is a report of Rock Village, a double component site, located in the Garrison Reservoir area of North Dakota, and a presentation of a chronological sequence of the Hidatsa tradition in the Northern Great Plains. The excavations provide a chronological framework of the Hidatsa tradition to which is added data based on ethno-historical materials. The earlier component, "A," at

Rock Village is a pre-pottery (non-Hidatsa) manifestation, and verifies the presence in the area of a lithic tradition prior to occupation by the cultivators (Hidatsa, Mandan and Arikara). The upper component, "B," is a protohistoric Hidatsa village occupied at the end of the nineteenth century. The identification of the site as Hidatsa was based on village settlement pattern, lodge type, and artifacts (particularly those associated with the Stone Hammer Society) all of which were compared to ethnological reports by Gilbert N. Wilson.

The Rock Village people were basically cultivators (primarily corn, squash, and beans), and supplemented their diet with wild plants and meat such as bison, elk, and deer. The materials utilized for tools reflect the local ecology, for example, bison tools and stone work, of Knife River flint, both of which were abundant locally. Additionally, extensive trading, both Indian and European, is indicated. The well-fortified settlement pattern (thirty-five to forty closely spaced lodges enclosed by fortifications consisting of a ditch and palisade) suggests a tightly-knit social and political organization such as indicated by Wilson for the historic Hidatsa. The refuse attributable to the village occupation, although plentiful, did not indicate extended occupation.

The chronology for the Hidatsa tradition is based upon Lehmer's "Fort Pierre Branch" of central South Dakota and the Midwestern Taxonomic system. Utilizing archaeological reports, ethnographic monographs, and history in its broadest sense, the following chronology is suggested by the present writer: Pre-Hidatsa (Prehistoric) pre-1500, Hidatsa Migration (Prehistoric) 1500-1650, Hidatsa-Mandan Contact (Prehistoric) 1650-1700, Mandan Domination (Pre- and Protohistoric) 1700-1764, Hidatsa Domination (Protohistoric and Historic) 1737-1838, Hidatsa Decadent (Historic) 1838-1890, and Hidatsa Modern (Historic) 1890-Present.

This chronology includes a precise measurement of the developmental periods within the Hidatsa tradition from their entrance into this region in the vicinity of the Heart And Grand Rivers (Hidatsa Migration, 1500-1650), to their final movement to individual holdings on Fort Berthold, North Dakota (Hidatsa Modern, 1890-Present). Rock Village undoubtedly represents the type of village involved in the initial phases of trade relations which culminated in the Upper Middle Missouri area at the Knife River villages of the Hidatsa and Mandan after 1800, but prior to 1838.

Microfilm \$4.80; Xerox \$16.90. 374 pages.

BACTERIOLOGY

UREA UTILIZING ORGANISMS FROM THE RUMEN

(L. C. Card No. Mic 60-6787)

Edward James Carroll, Ph.D.
University of Missouri, 1960

Supervisor: Merle Muhrer

Urealytic organisms were isolated from the rumen of a fistulated steer and a fistulated sheep fed a standard maintenance ration, and from the rumen of two fistulated sheep fed a synthetic ration containing urea as the nitrogen source. Isolations were made in two media. The first medium contained urea, balanced salts, glucose, various levels of rumen fluid, reducing agent and buffer. The second medium contained urea, glucose, macro and micro minerals, purines, pyrimidines, vitamins, reducing agent and phosphate or carbonate buffer. For these media, nitrogen or carbon-dioxide was the gas phase and anaerobic conditions were maintained in rolled agar tubes. Aerobic isolations were obtained on standard urea agars. These isolations were made from some 36 separate dilution series of rumen fluid in these media.

Non-urealytic streptococci capable of growth on ammonia were present in the rumen of experimental animals in such high numbers that they overgrew most other species in the anaerobic isolation media used. Most of these organisms were identified as *Streptococcus bovis*.

Several strains of urealytic micrococci were isolated in numbers of 10^4 to 10^5 per ml. Urealytic actinomycetes were found in all rumens at 10^4 per ml. The urease of

these organisms was constitutive when grown either aerobically or anaerobically, as well as on either complex nitrogenous media or ammonia.

Two strains of *Lactobacillus bifidus* were isolated from the steer rumen in numbers of 10^7 per ml. This organism failed to grow in broths exposed to oxygen and failed to produce urease when grown on complex nitrogen sources.

Three morphologically similar urealytic organisms were isolated, respectively, at dilutions of 10^{-4} and at 10^{-5} aerobically and of 10^{-8} anaerobically. These organisms grew as long serpentine filaments on primary isolation. The 10^{-4} organism proved to be the most active urealytic organism of all isolates. The organisms isolated at dilutions of 10^{-5} and 10^{-8} were very active in hydrolyzing urea on primary isolation. Urease was constitutive in 10^{-4} but not in the latter two. Continued passage through media containing urea eventually restored urealytic ability in the 10^{-8} organism. These organisms produced mucoid colonies and on continued laboratory culture grew as very short, fat rods. No described rumen organisms resemble these isolates and their taxonomy is in question. They have many features in common with the *Corynebacteriaceae*.

No Gram-negative forms were isolated. Little difference in urealytic activity could be shown between the rumen microorganisms of the animals on the two rations.

Three lactate utilizers were isolated from the urea media at dilutions of 10^{-8} . They failed to grow on the same media containing ammonia. One produced CO_2 , propionate, acetate, formate and ethanol from glucose and the other two produced CO_2 , valerate, propionate and acetate. These organisms had characteristics common to both *Propionibacteria* and *Corynebacteria*.

The rate of urea hydrolysis *in vitro* was determined in short-term fermentations. Hydrolysis of 246 mg. urea/hr./100 ml. of rumen contents was found. Air or CO₂ atmosphere had little to no effect on the urease activity.

The urease activity of washed-cell-suspensions of the urealytic isolates indicated they could not account for the activity observed in the rumen fluid.

It was concluded that either the cultural methods were not adequate to isolate all urease producing organisms or that low levels of urease must be present in many species in the rumen rather than in a few active urea hydrolyzers. These studies reported here indicated that the capacity of rumen fluid to hydrolyze urea exceeds its capacity to utilize the ammonia so formed.

Microfilm \$2.75; Xerox \$7.20. 153 pages.

BIOCHEMICAL STUDIES ON *C. BURNETII*.

(L. C. Card No. Mic 61-272)

Richard A. Consigli, Ph.D.
University of Kansas, 1960

The purpose of these studies was to use a biochemical approach to elucidate the host-parasite interrelationship involving *Coxiella burnetii*. These studies indicate that *C. burnetii* possess the following metabolic capabilities:

(1) The ability to oxidize G-6-P to 6-P-G on the basis of: (a) TPN⁺ reduction, (b) chromatographic isolation of 6-P-G, (c) the trapping of intermediate 6-P-δ-G, (d) the reduction of 6-P-δ-G, and (e) lack of comparable activity in various NYS preparations.

(2) Carbamoylase activity which cleaves CP to carbamate + Pi at the rate of 1.10 μmoles of Pi/mg of rickettsial nitrogen.

(3) The ability to synthesize citrulline at the rate of 3.10 μmoles of citrulline/mg of rickettsial nitrogen. NYS preparations showed no activity.

(4) The ability to synthesize ureidosuccinate at the rate of 1.12 μmoles of ureidosuccinate/mg of rickettsial nitrogen, as compared to 0.09 μmoles for the NYS preparation.

(5) The ability to synthesize ATP as demonstrated indirectly by the formation of G-6-P. These studies also indicate that *C. burnetii* possesses a hexokinase type of enzyme which phosphorylates glucose to G-6-P. This is proposed on the basis of: (a) TPN⁺ reduction data, (b) chromatographic isolation of G-6-P, (c) P³² data, (d) the lack of comparable enzymatic activity by various purified preparations obtained from NYS.

(6) The ability of *C. burnetii* to oxidize isocitric acid to oxalsuccinate, and low activity obtained from NYS preparations. These basic studies will provide a better understanding of the host-parasite interaction involved in rickettsial pathogenesis.

Microfilm \$2.75; Xerox \$9.45. 206 pages.

STUDIES ON THE PERSISTENT INFECTION OF TISSUE CULTURE WITH MENINGOPNEUMONITIS VIRUS

(L. C. Card No. Mic 60-6987)

George John Galasso, Ph.D.
The University of North Carolina, 1960

Supervisor: Dr. G. P. Manire

Psittacosis viruses have been cultivated in a variety of tissue culture systems but growth in HeLa cells has not been reported previously. Earlier studies in this laboratory had indicated that this might be feasible and an attempt was made to establish such an infection. The inoculation of large amounts of allantoic fluid adapted meningopneumonitis virus into cultures of HeLa cells in maintenance solution resulted in no detectable cytopathogenic effect or virus growth. In order to determine whether the virus might be in either a latent state or whether viral replication was inhibited due to improper nutrient, cultures of HeLa cells were inoculated with virus and Eagle's nutrient medium containing 10 percent human serum was added. After an adaptive period, virus in increasing amounts was observed, but high titers of virus did not cause the destruction of the cell culture. A persistent infection was established wherein meningopneumonitis virus formed a stable relationship with HeLa cells, and in which cell damage, cell proliferation and virus production were in balance. A single culture has been maintained for two years, continually producing virus in high titer.

An attempt was made to determine the mechanism responsible for the persistent infection. The cultures were tested for the presence of an interferon type substance with negative results. The effect of histone and secondary infection of polio were examined; however, the mechanism, whereby the cells in these infected cultures are not completely destroyed when constantly bathed in high concentrations of very infectious virus, remains unexplained.

The infected cultures can be trypsinized and the persistent infection maintained through several subcultures. Periodic microscopic observations of infected cells show the developmental cycle of the intracellular inclusions to be the same as that described in earlier studies in chick embryo cells. The electron microscope examination of virus suspensions shows that the HeLa-MP virus has a larger proportion of small to large forms as compared to the allantoic fluid adapted virus. Comparison of toxicity and egg infectivity characteristics of HeLa-MP virus and virus from the allantoic cavity has shown that the former appears to be more infectious but there are no significant differences in toxicity, on a particle basis.

This persistent infection appears to be an excellent tool for the study of the effects of antibiotics and antiserum on a psittacosis infection. Low levels of penicillin, tetracycline HCl, chloramphenicol and antiserum were used so as to render the results more applicable to animal hosts. Antiserum did not cause a significant inhibition of virus in established infections, but if it was present prior to infection there was some inhibition as compared to the untreated controls. The free virus appears to be affected but the intracellular virus seems to be able to spread by direct extension. Penicillin was more effective in inhibiting viral replication but failed to prevent virus growth even when the cultures were treated

with 500 μ /ml for 3½ months. If treatment with chloramphenicol and tetracycline is continued for a sufficient period, these agents are able to eradicate the virus. The presence of 10 μ g/ml of tetracycline for 14 days or 10-25 μ g/ml of chloramphenicol for 21 days was sufficient to remove all traces of virus. Treatment for less than the specified time caused a drop in titer but once the antiviral agent was removed, virus production returned to a range similar to that of the control. Tetracycline was also shown to have an in vitro effect on the virus.

Microfilm \$2.75; Xerox \$6.40. 131 pages.

**NUTRITIONAL SYMBIOSIS BETWEEN
LACTOBACILLUS PLANTARUM
AND STREPTOCOCCUS FAECALIS**

(L. C. Card No. Mic 61-423)

Noel Roger Krieg, Ph.D.
University of Maryland, 1960

Supervisor: Dr. Michael J. Pelczar, Jr.

This investigation was undertaken in order to characterize more completely a nutritional symbiosis between lactic acid bacteria described for the first time in 1954. Symbiosis between *Lactobacillus plantarum* strain 17-5 and *Streptococcus faecalis* strain R was demonstrated in a chemically-defined medium lacking phenylalanine (a growth factor required by *L. plantarum*) and pteroylglutamic acid (a growth factor required by *S. faecalis*). Individually, neither organism grew in this medium, but in mixed culture both organisms exhibited abundant growth. The presence of p-aminobenzoic acid was essential for symbiotic growth to occur.

Enumeration of symbionts was found to be possible by standard plate count techniques employing trypticase soy agar plus 0.25 per cent glucose at pH 9.0 (which supported the growth of only the streptococcus) and pH 7.3 (which supported the growth of both symbionts). The counts of *L. plantarum* could be obtained by the difference between the counts obtained on these 2 media. It was found that *S. faecalis* grew rapidly in the mixed culture and predominated in the early stages, but that *L. plantarum* eventually predominated upon further incubation.

In pure culture, it was found that micro inoculum broth was less favorable for the growth of *L. plantarum*, which reached standard plate counts as high as 5×10^6 in the synthetic chemically-defined medium.

Physiological studies of *L. plantarum* revealed that thymine, cytosine and cytidylic acid at concentrations of 0.01 and 0.10 μ g per ml did not replace the p-aminobenzoic acid requirement of *L. plantarum*, and that thymidine not only supported the growth of the organism at concentrations higher than 0.10 μ g per ml, but also was found to non-competitively reverse sulfathiazole inhibition. 2-chloro-4-aminobenzoic acid, sometimes used as an inhibitor of p-aminobenzoic acid, was found to replace the requirement of the organism for the latter. Aminopterin exercised an inhibitory effect against the organism.

The inhibition of growth of *L. plantarum* by high concentrations of sulfathiazole was reversed non-competitively by pteroylglutamic acid, but only after prolonged incubation.

When a cell suspension was plated in an agar medium of similar composition, containing pteroylglutamic acid and sulfathiazole, daily counts from the same plate revealed increasing numbers of colonies up to the 7th day, when the count approached the total number of cells plated. This total recovery of the organisms indicated that a mutational event was not involved in the delayed reversal effect. Degradation of pteroylglutamic acid to p-aminobenzoic acid, p-aminobenzoylglutamic acid, or pteric acid was ruled out as a factor because these compounds could not reverse the sulfathiazole inhibition when deliberately incorporated into the medium. Spontaneous changes of the medium following prolonged incubation were also eliminated as a possible explanation for the delayed response. Colonies isolated from the pteroylglutamic acid-sulfathiazole plates after prolonged incubation did not exhibit an immediate growth response upon subculture in pteroylglutamic acid-sulfathiazole broth; therefore, a typical adaptive process would appear to be absent. Possible explanations for the phenomenon of delayed response to pteroylglutamic acid are discussed.

Characterization by a bioautographic technique of the phenylalanine-active factor synthesized by *S. faecalis* indicated that the factor was not identical to either phenylalanine or shikimic acid.

Microbiological assays of the spent medium from cultures of *L. plantarum* indicated that 3 types of folic acid compounds were synthesized: (a) oxygen-stable compounds which supported the growth of *Pedococcus cerevisiae*; (b) oxygen-labile compounds which supported the growth of *P. cerevisiae*; and (c) oxygen-stable compounds which supported the growth of *S. faecalis* but not of *P. cerevisiae*. The possible nature of these compounds is discussed.

Microfilm \$2.75; Xerox \$6.00. 121 pages.

**STUDIES ON THE PHYSIOLOGY
AND BIOCHEMISTRY OF THE
CHEMOAUTOTROPHIC NITRIFYING
BACTERIUM NITROBACTER AGILIS**

(L. C. Card No. Mic 61-514)

Arthur Eric Krikszens, Ph.D.
Syracuse University, 1960

Studies leading to a suitable growth medium for *N. agilis* were made using both Meiklejohn's medium and that of Aleem and Alexander. A resultant modification of Aleem and Alexander's medium was used employing both shaken flasks and fermentors for mass production of *N. agilis*.

The studies concerned with modification of media led to a characterization in part of the nitrite-oxidizing system and determinations of the effects of various common metabolic intermediates on the growth and nitrite-oxidizing ability of *N. agilis*. Results indicated that concentrations of nitrite up to 300 ppm produced little or no growth lag; beyond this level, lag increased steadily. Optimum pH range for nitrite oxidation was pH 7.5 to 8.0, with nitrite-oxidation falling off rapidly on either side of these values. Iron was found to be critical for oxidation with an apparent optimum concentration of 2.0 mg Fe/L.

Results of studies of the effect of organic intermediates

on growth of *N. agilis* showed that: (1) organic intermediates could not serve as sole sources of energy; (2) most of the intermediates had some inhibitory action on the nitrite oxidation; (3) inhibition may be related to the chelating power of the substances.

Studies of the nitrite-oxidizing system (nitrite oxidase) of *N. agilis* substantiated results obtained with whole cells. Nitrite oxidase of cell-free extracts oxidized increasing concentrations of nitrite up to 300 ppm without any lag. The optimum ranged from pH 7.5 to 8.0 and optimum iron concentration was 2.0 mg Fe/L.

Studies of the oxidation of organic intermediates using cell-free extracts gave results entirely different from those observed using intact cells. Employing manometric techniques and spectrophotometric methods for quantitation along with metabolic poisons, it was demonstrated that extracts of *N. agilis* were capable of metabolizing nearly all of the common glycolytic and TCA cycle intermediates. It was further shown that key reactions involving aldolase, condensing enzymes, alpha ketoglutarate dehydrogenase and succinic dehydrogenase could all occur in vitro. Microfilm \$2.75; Xerox \$5.40. 107 pages.

EXPERIMENTAL TULAREMIA IN WILD ANIMALS

(L. C. Card No. Mic 60-6232)

Nyven John Marchette, Ph.D.
University of Utah, 1960

Chairman: Dr. Paul S. Nicholes

The susceptibility to experimental tularemia infection of thirteen species of wild animals native to the Great Salt Lake Desert of Utah was tested. Eleven species of rodents, *Citellus leucurus*, antelope ground squirrel; *Eutamias minimus*, least chipmunk; *Perognathus formosus*, long-tailed pocket mouse; *Dipodomys ordii*, Ord kangaroo rat; *D. microps*, chisel-toothed kangaroo rat; *Reithrodontomys megalotis*, western harvest mouse; *Peromyscus crinitus*, canyon mouse; *P. maniculatus*, deer mouse; *Onychomys leucogaster*, northern grasshopper mouse; *Neotoma lepida*, desert wood rat; *Microtus montanus*, montane meadow mouse, were all lethally susceptible to subcutaneous inoculation of as few as one viable organism of the Schu A strain of *Pasteurella tularensis*. Cottontails, *Sylvilagus auduboni*, and jack rabbits, *Lepus californicus deserticola*, were as susceptible as the rodents tested. However, a subspecies, *L. c. texianus*, from New Mexico survived subcutaneous inoculation of more than 10^3 times the number of organisms necessary to kill the Utah subspecies, *L. c. deserticola*.

Massive doses (10^9 viable organisms or greater) of *P. tularensis* strain Schu A inoculated subcutaneously into coyote pups, *Canis latrans lestes*, caused the death of two out of the three tested. Inoculation of lower doses or exposure to oral infection caused only a mild, subacute infection in other pups of this species. No chronic infection or carrier state was detectable in the survivors.

Twelve strains of *P. tularensis* isolated from wild rabbits, rodents, or ticks, and one strain isolated from a horse were highly virulent for grasshopper mice, wood

rats, and/or deer mice. The 38 strain and the Russian NIIEG (gray var.) strains were avirulent for these rodents. The blue variant of the NIIEG strain, however, was moderately virulent for deer mice and wood rats.

Five laboratory and 13 wild strains of *P. tularensis* of varying virulence were tested for the ability to metabolize citrulline. Only those strains which were of high virulence for mice, guinea pigs, and white rabbits were found to possess a citrulline ureidase enzyme system. This enzyme system was absent from all avirulent strains and strains of low virulence for rabbits that were tested. The only wild strains of *P. tularensis* tested that lacked a citrulline ureidase enzyme system were two that had been isolated from a rodent (*M. montanus*) and rodent ticks (*Dermacentor andersoni*) respectively. These strains were also of low virulence for rabbits.

It was possible to demonstrate that there is no direct cause and effect relationship between the presence of a citrulline ureidase enzyme system and virulence of *P. tularensis* for rabbits. Neither of two colonial variants of the virulent-citrulline ureidase enzyme possessing Schu A strain produced by culture techniques were virulent for white rabbits in doses as high as 10^7 organisms inoculated subcutaneously. However, both variants possessed citrulline ureidase enzyme activity equal to that of the parent organism.

On the basis of the presence or absence of a citrulline ureidase enzyme system, it is postulated that there are two distinct varieties of *P. tularensis* in North America. The present study suggests the presence of a variety of *P. tularensis* which has evolved and is being maintained in the rodent and associated arthropod fauna, and one which has evolved and is maintained in the rabbit and its associated arthropod fauna. The rodent variety lacks a citrulline ureidase enzyme system and is avirulent or of low virulence for rabbits. The rabbit variety possesses a citrulline ureidase enzyme system and is highly virulent for rabbits. Microfilm \$2.75; Xerox \$4.60. 87 pages.

THE EVALUATION OF A MASTITIS CONTROL PROGRAM IN SOUTHWEST MISSOURI

(L. C. Card No. Mic 60-6813)

Robert Thomas Marshall, Ph.D.
University of Missouri, 1960

Supervisor: Dr. J. E. Edmondson

A field study in mastitis control was performed on nine herds in Lawrence County, Missouri, to determine to what extent the application of a laboratory controlled program of mastitis prevention and eradication could be expected to reduce mastitis within the herds involved.

Changes in the California Mastitis Test (CMT) score were used to reflect changes in inflammation. The herd mean CMT scores were used to ascertain the value of the program. In all but one herd there was a decrease in the average amount of inflammation per quarter. In this one herd the average remained the same. The composite average CMT score per quarter dropped from 1.32 in August to 0.94 after 40 weeks. The decrease was due to a drop of 16 per cent in the quarters reacting CMT-3 or CMT-4.

An increase of 12 per cent in quarters scored CMT-negative or CMT-1 and of four per cent for quarters scored CMT-2 accounted for the above decreases.

The Hotis-Microscopic and Hotis-Blood Plate methods were used to detect specific types of infection.

The strip cup test was found to detect only 19.1 per cent of the quarters giving milk scored CMT-4 (strongly positive).

Twenty-two per cent of the variation in CMT scores could be explained by factors associated with variations in age.

CMT scores can be corrected for age differences between herds by use of a linear regression equation.

Infections in young animals cause only a slightly lower amount of inflammation, on the average, than in cows five years of age or older.

The Standard Plate Count is of little value for detecting mastitis.

The California Mastitis Test is an excellent tool for screening herds for infected quarters. From 90 to 95 per cent of all samples scored CMT-3 and CMT-4 were found to be culturally positive.

Seventy per cent of the infecting organisms were staphylococci, ten per cent *S. agalactiae*, and 20 per cent of the quarters shed both *S. agalactiae* and staphylococci. Significantly more inflammation ($P < 0.01$) was found in quarters shedding both *S. agalactiae* and staphylococci than in those shedding only staphylococci.

No cultures of *S. agalactiae* were found resistant to penicillin, chlortetracycline, furacin or neomycin.

Twenty-two per cent of 541 staphylococcal cultures were penicillin resistant. Resistance to chlortetracycline among the same group was 7.2 per cent, to furacin 2.4 per cent, and to neomycin 2.0 per cent.

Slightly less than 50 per cent of quarters treated by the diarmen were relieved of infection.

The average cost for treatment was \$5.47 per cow treated for the 40 week period. This included milk losses. The average cost per 26 cow herd per year was estimated to be slightly over \$100.00.

Herds showing approximately the same rates of staphylococcal infection may show markedly different rates of inflammation.

In the author's opinion, when the average monthly CMT score per quarter is 0.75 or less, the dairyman can be assured that his mastitis control program is effective.

Primary emphasis should be placed upon the eradication of *S. agalactiae* from Missouri herds. Improvements in milking techniques, milking machine care and operation, sanitation and herd management must be made simultaneously. If, after these steps have been accomplished, high rates of inflammation persist, cultural tests, including drug sensitivity tests, should be performed prior to generalized treatment of staphylococci-infected quarters. A program of eradication of staphylococci from the dairy herd may necessitate sale of a large proportion of the cows five years of age or over.

Microfilm \$3.20; Xerox \$11.25. 247 pages.

FACTORS INFLUENCING ACTIVITY OF MICROBIAL LIPASES

(L. C. Card No. Mic 61-456)

John Clair Mickelson, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: F. Eugene Nelson

The release of fatty acids from butterfat by microbial lipases was studied, using partition chromatography for separating some of the fatty acids of low molecular weight. The substrate used was a modification of the Nashif and Nelson (2) sodium taurocholate emulsion with butterfat substituted for coconut oil and merthiolate substituted for formaldehyde. The acids were first extracted from the emulsion using the chromatographic extraction technique of Kemp and Hetrick (1). The extraction solvent was then removed by fractional distillation leaving the extracted fat and fatty acids in solution in isooctane. A portion of this was then analyzed by a modification of the Kemp and Hetrick (1) partition chromatography technique. The column consisted of methanol adsorbed onto silicic acid and slurried with isooctane saturated with 90 per cent methanol. A portion of the extract was placed on the column, which was then developed with isooctane saturated with 90 per cent methanol. The effluent was manually collected as small (1.0 to 10.0 ml.) fractions, each being titrated to a phenolphthalein end point with approximately 0.0150N base. This procedure differed from that of Kemp and Hetrick (1) in that the acid-base indicator was not used since visual separation of the acids is unnecessary when fractions are taken. This also made the use of NH_4OH unnecessary. Butyric, caproic, caprylic and capric acids were separated by this technique with a fifth fraction containing lauric acid and those of greater molecular weight.

Comparisons were made of the acids released from the butterfat by the lipases of three different lipolytic microorganisms. The lipase of *Candida lipolytica* preferentially released capric acid from the butterfat substrate. Caprylic acid, while released to a somewhat lesser degree, still could be considered to be released preferentially.

The lipase of *Geotrichum candidum* released no detectable amounts of butyric acid and only small amounts of caproic acid from butterfat. Capric acid was released in very large quantities, exceeding even that released by the lipase of *Pseudomonas fragi*.

The lipase of *Pseudomonas fragi* released considerable quantities of butyric, caproic, caprylic and capric acids. After 48 hours incubation at 32° C., a high percentage of the caprylic acid had been released. On further incubation, the amount of caprylic acid released increased very slowly, while other acids, especially capric acid, were released to a greater degree. An increase both in total activity and in rate of activity was exhibited when the ratio of surface area to volume in the enzyme-substrate reaction environment was reduced, suggesting that this enzyme might be sensitive to oxidation.

After 30 minutes at a temperature of 62.1° C., the lipase of *Pseudomonas fragi* retained 55 to 68 per cent of its activity. A large portion of the activity lost was found to occur during the time required to bring the enzyme

preparation up to 62.1° C. The non-uniform heat inactivation suggested the presence of more than one lipolytic enzyme in the crude preparation.

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2. Nashif, S. A. and Nelson, F. E. The lipase of *Pseudomonas fragi*. I. Characterization of the enzyme. *J. Dairy Sci.*, 36: 459-470. 1953.
Microfilm \$2.75; Xerox \$5.00. 97 pages.

PROPERTIES OF *E. COLI* CELLS
SUSCEPTIBLE TO THE
PROTOPLAST-INFECTING AGENT PI.

(L. C. Card No. Mic 60-6317)

Charles Julius Pfau, Ph.D.
Indiana University, 1960

When bacteriophage T2 is treated with 6 M urea a new infectious agent is obtained. This agent, pi, is capable of infecting protoplasts whereas intact T2 cannot. However, pi mixed with intact cells always reveals a "background" titer about five log units lower than the assay with protoplasts. Because pi could infect cells of *E. coli* B or B/2 to almost the same extent, it was believed that undamaged T2 in the preparation could not be responsible for background titers. Since the rates of inactivation of pi by heat, trypsin, and DNase were the same, with respect to cells and protoplasts, the possibility of atypical pi in the preparation seemed untenable. Furthermore, the background titers depended quite markedly on the age of the culture, and it was felt that the normal population contained unusual cells (background cells) which could be infected by pi. After centrifuging pi the combined assays of the resulting supernatant and pellet revealed only 30% of the titer obtained when both were recombined. These observations indicated that background titers resulted from the action of pi plus some other component. The following evidence indicated that this component was "phage-tail" enzyme: 1) phage-tail enzyme could be detected in pi preparations according to the technique of Dreyer and Koch, 2) T2 tail enzyme, obtained from a T2 lysate, could substitute for that found in a T2h pi preparation, and 3) purified T4 tail enzyme could partially substitute for that found in a T2 pi preparation.

Using cultures containing the highest proportion of pi-infectable bacteria, it was demonstrated that RNase treatment rendered a large number of the cells (40-50%) incapable of producing infective centers after phage adsorption. This RNase phenomenon could not be demonstrated with: 1) log-phase cells, 2) cells treated with the enzyme after phage infection, and 3) cells exposed to a mixture of ATP and the four RNA nucleosides after the RNase treatment, and either before or after phage adsorption. While studying the low adsorption- and high abortive infection rates of the stored cells (cultures, showing the highest proportion of pi-infectable bacteria, kept at 2°C for two weeks), it was

found that all cells adsorbed phage at the same rate regardless of whether they had been enzymatically treated. Restoration (after the adsorption period (ATP and the nucleosides), produced an increase of about 50% in the number of infective centers - as compared to the non-RNase'd cells. Attempts were made to localize the viral DNA prior to restoration procedures. The Waring blending method of Hershey and Chase (which is reported to strip phage from cells) proved unsuccessful. This treatment did not interfere with the reversal of the RNase effects by the restoration medium. However, when the efficiency of the blending was checked by employing S³⁵ labeled T2, it was found that although this procedure liberated some 80% of the phage from fresh log-phase cells, no indication of stripping was apparent when the stored cells were used. Microfilm \$2.75; Xerox \$5.60. 112 pages.

PENICILLIN IN MILK USED FOR
COTTAGE CHEESE MAKING

(L. C. Card No. Mic 60-6823)

Kenneth Leroy Smith, Ph.D.
University of Missouri, 1960

Supervisor: Dr. J. E. Edmondson

The presence of penicillin in milk or dairy products is expressly prohibited by the Food and Drug Administration. Reports in the literature indicate that the common dairy processes have little or no destructive effect on penicillin in milk. No data were found concerning the destruction of penicillin in milk used for cottage cheese making. This experiment was undertaken to determine if low levels of penicillin in skim milk are destroyed by the cottage cheese making process.

One hundred and twenty-eight pure strains of Gram positive cocci were isolated from 11 commercial cottage cheese cultures. All isolates were members of the genus *Streptococcus*. Members of the lactic group comprised 87.5 per cent of the total number of strains and 12.5 per cent were members of the enterococcus group. The species identified and the per cent of the total isolates were as follows: *S. lactis*, 39.1 per cent; *S. cremoris*, 31.2 per cent; *S. faecalis*, 7.8 per cent; and *S. durans*, 4.7 per cent. In the lactic group, 22 strains, or 17.2 per cent, of the total isolates had characteristics intermediate between those of *S. lactis* and *S. cremoris*.

A maximum penicillin tolerance of 0.1 units per milliliter was found for 62.2 per cent of the 45 isolates tested. Penicillin levels above 0.1 units were tolerated by 24.5 per cent of the cultures and 13.3 per cent would not grow consistently in broth containing 0.1 units of penicillin. The maximum level of penicillin tolerated consistently by any of the cultures was 0.3 units per milliliter. Individual cultures exhibited large daily variations in their ability to grow in the presence of penicillin.

Acid production and setting time were not affected in cottage cheese made from skim milk containing 0.05 units of penicillin per milliliter. The use of skim milk containing 0.1 units of penicillin resulted in occasional failures in making cottage cheese. Skim milk containing 0.15 units of penicillin was unsatisfactory for use in making

cottage cheese. At the time of cutting, detectable amounts of penicillin were still present in the curd in every vat of cheese which was made from skim milk containing penicillin.

Cooking cottage cheese curd which contained 0.1 or 0.2 units of penicillin at 49, 52 or 55°C. for two hours did not completely destroy the penicillin. It appears that the normal cottage cheese making process will not completely destroy even low levels of penicillin.

The pH of the whey used as the diluent for the penicillin standard has a pronounced effect on the size of the zone of inhibition produced by low levels of penicillin. As the pH decreases the size of the zone of inhibition increases when the diluent is a buffered material such as whey. This relationship is not exhibited when an unbuffered diluent such as distilled water is used. It seems probable that the increased hydrogen ion concentration increases the rate of diffusion of the penicillin through the agar.

Microfilm \$2.75; Xerox \$4.40. 85 pages.

THE MICROBIAL DISSIMILATION OF AROMATIC METHYL ETHERS

(L. C. Card No. Mic 60-6335)

Eric Torrance Woodings, Ph.D.
Indiana University, 1960

Although lignin is one of the most abundant plant constituents, our knowledge of the decomposition of this complex polymer is quite meager. The paucity of information is due, in part, to the fact that the exact chemical structure of lignin is still obscure and that no satisfactory method for the isolation of lignin is available. Recently, however, the decomposition of this complex polymer has been approached through the study of the microbial dissimilation of chemically defined dimers and monomers of the lignin polymer. A previous investigation revealed that several members of the genus *Pseudomonas* were capable of utilizing a variety of aromatic methyl ethers as sole sources of carbon and energy. Compounds such as anisic acid or veratric acid were demethylated early in the course of their dissimilation. The purpose of this study was to determine the manner in which soil bacteria dissimilate aromatic methyl ethers.

Results obtained using resting cells of the pseudomonads indicated the following:

1. Aromatic methyl ethers, such as anisic acid, vanillic acid or veratric acid, were demethylated by adaptive enzyme systems early in the course of their dissimilation and were converted to the common intermediate, protocatechuic acid, prior to aromatic ring cleavage.

2. Manometric studies and chromatographic and spectrophotometric analysis revealed that methoxybenzoic acids were first converted to the corresponding hydroxybenzoic acids. The methoxyl carbon was recovered quantitatively as formaldehyde when semicarbazide was used as a trapping agent. In the absence of semicarbazide, methoxyl carbon was oxidized terminally to carbon dioxide.

3. Bacteria grown on *meta*- or *para*-methoxylated substrates were adapted to the removal of only *meta*- or *para*-methoxyl groups respectively. Bacteria adapted to compounds containing both *meta*- and *para*-methoxyl groups could demethylate either or both positions on a variety of other aromatic methyl ethers.

4. Aromatic methyl ethers more complex than methoxybenzoic acids were converted to the corresponding substituted benzoic acids before demethylation occurred. Thus, ferulic acid was converted to vanillic acid and anisyl acetate was converted to anisic acid before being demethylated.

5. When the aromatic ether contained a three carbon side chain as in 3,4-dimethoxycinnamic acid, the compound was first oxidized to the corresponding benzoic acid, veratric acid. The 2-carbon fragment removed by this process was acetate and the oxidation resembled *beta*-oxidation since adenosine triphosphate, magnesium and coenzyme A were required for the acyl activation reaction.

6. Certain esters of cinnamic acid (cinnamyl formate, cinnamyl acetate, cinnamyl propionate and cinnamyl butyrate) were first converted to cinnamic acid by hydrolysis of the ester linkage. The aliphatic acids, thus released, were oxidized to carbon dioxide and water. Cinnamic acid was presumably oxidized in the same manner as that determined for methoxycinnamic acids.

7. Resting cells adapted to various aromatic methyl ethers were unable to oxidize isolated lignin preparations or other complex lignin-related compounds. It appears therefore that complex methoxylated materials must be degraded to simpler compounds before bacterial enzymes can effect their demethylation.

Microfilm \$2.75; Xerox \$7.60. 162 pages.

BIOGRAPHY

BURTON K. WHEELER OF MONTANA: A PROGRESSIVE BETWEEN THE WARS.

(L. C. Card No. Mic 60-6087)

Richard T. Ruetten, Ph.D.
University of Oregon, 1961

Advisers: Wendell H. Stephenson
Earl Pomeroy

Burton K. Wheeler's longevity and the absence of his personal papers have discouraged historians from examining his long and colorful career. The author reduced part of the problem by exploiting the papers of Thomas J. Walsh, Hiram W. Johnson, Jonathan Bourne, Walter M. Pierce, Joseph Kinsey Howard, the America First Committee, and the Oregon Commonwealth Federation. Interviews and correspondence with Wheeler and his contemporaries, the excellent newspaper files of the Historical Society of Montana, state and national government publications, and numerous magazine and journal articles added supplemental evidence about the controversial Senator.

Never a theorist, Wheeler preferred concrete problems, but underscoring his daily decisions lurked an Actonian fear of power and a belief that bigness itself carried inherent evils. In the 1920's, when business and a conservative climate scuttled progressive attempts at regulation and control, he saw a struggle between property rights and human rights, between East and West, between rich and poor. He ran for the vice-presidency with Robert M. La Follette on the Progressive ticket of 1924, and he played the leading role in forcing Attorney General Harry M. Daugherty from the cabinet of Calvin Coolidge. His career during the prosperity decade demonstrated that a spirit, if not an age, of reform linked the progressive era with the New Deal, although his sectionalism resembled Populism more than prewar progressivism. As a democrat ideologically more than a Democrat politically, he championed a new deal for the forgotten man in the 1920's and led the West in supporting Franklin D. Roosevelt in 1932.

In the 1930's, he remained hostile to the industrial giants, preferring atomism to regulation, and he sponsored

Roosevelt's holding company bill of 1935 as part of his campaign against bigness. But as early as the hundred days, he lashed at Congress for surrendering prerogatives to the executive; as the tribunal of popular sentiment, Congress should retain the bulk of political power. With the Court fight, the reorganization bill, and the coming of war, he saw the need for regulation of the executive, as well as for the business community. He changed his emphasis but not his conviction.

Until the Court fight, few questioned his right to the progressive label, but many cited his opposition to the President's plan as proof of a volte-face. When he praised the competitive economic system in speeches after 1937, his detractors failed to perceive that part of his rhetoric stemmed from presidential ambitions for 1940, as well as from sincere conviction. Although inconsistency and contradiction pervaded many of his arguments, his major contentions were remarkably consistent. He changed less than many politicians, although his critics accused him of changing more; he was not a radical in 1920, nor was he a reactionary in 1940.

Throughout his political career, Wheeler opposed imperialism, war, and entangling alliances. He had no sense of mission, no desire to export democracy anywhere. The First World War (and the growing revisionist literature about it), his suspicions of Wall Street, and the political reaction of the 1920's convinced him that American participation in another conflict would bring disaster and internal dictatorship. America had a destiny of its own, he believed, distinct from Europe where countries fought because of economic greed. This economic fixation blinded him to the possibility that a leader's lust for power could provoke war, even though he recognized the corruptibility of political power.

In 1940, as he saw America plunging down the road to war, he lost his spirit of adventure and his hope for the future. Unwittingly, he was robbing himself of his progressive credentials. An economic explanation for nearly everything, a quasi-deterministic view of history, and a mind cemented in self-righteousness formed a fatal amalgam in a politician who was at heart an optimist and a democrat. Microfilm \$4.30; Xerox \$15.10. 334 pages.

BIOLOGY - GENETICS

ROLE OF SEXLINKED GENES IN QUANTITATIVE INHERITANCE

(L. C. Card No. Mic 61-437)

Neeti Ranjan Bohidar, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Oscar Kempthorne

The chief objective of this study was to examine the role of sexlinked genes in quantitative inheritance. Two methods of approach were used, the mathematical approach and the Monte Carlo approach. Numerical solutions to some of the problems which did not yield to algebraic solution were obtained by Monte Carlo method.

The partition of the total genotypic variance in a random mating population for both sexes and the construction of the fundamental structures of the covariances between two members of the same sex or different sexes were achieved algebraically under the simultaneous consideration of autosomal, sexlinked and partially sexlinked inheritance. Epistatic deviations arising from all possible gene-interactions were considered in this derivation.

Simple relationships among probabilities of genes being alike by descent and recurrence relations were established to study the progress of panmictic index with regular or irregular systems of inbreeding under the assumption of sexlinked transmission.

The general structure of the covariance between relatives was derived under the assumption of inbreeding followed by random mating.

The mathematical consequences of the assumption that the effects of genes are sex-dependent on the structures of the total genotypic variance and covariances between relatives were examined.

Procedures for the estimation of components of genetic variance from the analysis of variance were given for the case when the characteristic is expressed by either sex and the heritability estimators were derived under the assumption of sexlinked inheritance.

A Monte Carlo investigation was undertaken to study the effect of linkage on the efficiency of selection. A program for the Cylcone computer was written to accommodate any combination of the following facets: type of initial population, dominance, epistacy, linkage relations, selection intensity and some types of selection. Four types of dominance, three cases of expression of characteristics, three types of selection, two selection intensities and nine types of linkage relationships were considered in the actual numerical work. The results gave indications of the roles of these factors on the effects of selection.

Microfilm \$4.70; Xerox \$16.45. 365 pages.

INHIBITION ANALYSIS OF AROMATIC AMINO ACID-REQUIRING MUTANTS OF NEUROSPORA CRASSA

(L. C. Card No. Mic 60-3304)

Herman Eldon Brockman, Ph.D.

The Florida State University, 1960

The influence of various naturally occurring metabolites on the growth of three aromatic amino acid requiring-mutants of Neurospora crassa was investigated. The growth requirement of the mutant strains used in the study, T-145, E-5212, and FS-108, was satisfied by tyrosine or p-hydroxyphenylpyruvic acid, phenylalanine or phenylpyruvic acid, and indole or tryptophan respectively. Fifteen of twenty-three amino acids were shown to inhibit phenylalanine utilization for growth in a competitive manner, while none of the amino acids, except leucine, were able to inhibit phenylpyruvic acid utilization for growth in E-5212. The amino acids capable of inhibiting phenylalanine utilization had characteristic inhibition indexes (the ratio of inhibiting amino acid to required amino acid which completely inhibits growth for three days) ranging from 10 to 200. In decreasing order of potency, the inhibitory amino acids were L-leucine, L-methionine, L-tyrosine, L-tryptophan, DL-norvaline, DL-norleucine, DL- α -aminobutyric acid, L-alanine, L-valine, L-serine, L-threonine, glycine, L-isoleucine, L-histidine, and DL-asparagine. L-cysteine, L-lysine, L-arginine, L-proline, L-glutamic acid, L-aspartic acid, L-cystine, and L-glutamine were noninhibitory at the greatest inhibition index tested, 500.

Certain keto acids inhibited keto acid utilization for growth competitively in both T-145 and E-5212, but the keto acids did not inhibit utilization of the required amino acid in either of these two mutants. The importance of the groups at the α -position in determining inhibition potency was further demonstrated by showing that α -hydroxyisovaleric acid does not completely inhibit either phenylalanine or phenylpyruvic acid utilization for growth in E-5212.

The same family of amino acids, except histidine, inhibited the growth of FS-108 on tryptophan, but none of the amino acids were able to inhibit indole utilization for growth. None of the growth antagonisms noted in the mutant strains were demonstrable in wild-type strains. When tested in less than inhibitory concentrations, certain amino acids enhanced the growth of FS-108 over that obtained in the presence of tryptophan alone. In general, the amino acids with the lowest inhibition indexes enhanced growth to the greatest extent. This sparing of the requirement occurred when the mutant was grown in the presence of tryptophan but not in the presence of indole.

Evidence is presented against the hypothesis that the site of inhibition is intracellular. Specifically, transamination in E-5212 and T-145 and steps in the conversion of tryptophan to nicotinic acid in FS-108 are probably not

affected by the inhibitory amino acids. The inhibitory action of phenylalanine on tryptophan uptake by FS-108 was demonstrated. All the experimental evidence is consistent with the hypothesis that the inhibitory amino acids exert their action at a site which is located at the cell membrane. It is proposed that there are separate sites in *Neurospora* responsible for the transport of keto acids and amino acids into the cell, as well as a specific site for indole.

Microfilm \$2.75; Xerox \$5.80. 117 pages.

THE GENERA *HEMIBERLESIA* AND
ABGRALLASPIS IN NORTH AMERICA
WITH EMPHASIS ON HOST RELATIONSHIPS
IN THE *H. HOWARDI* (COCKERELL) COMPLEX
(HOMOPTERA: COCCOIDEA: DIASPIDIDAE).

(L. C. Card No. Mic 61-413)

John Angus Davidson, Sr., Ph.D.
University of Maryland, 1960

Supervisor: William E. Bickley

The work reported consists of revisionary studies of *Hemiberlesia* Cockerell 1897 and *Abgrallaspis* Balachowsky 1948 in North America. The interpretation of North America is that of Ferris (1937), "all the mainland from the Arctic regions to and including the Panama Canal Zone." According to Ferris (1942), *Hemiberlesia* contained 15 species. As a result of this study, only eight of these species are here referred to *Hemiberlesia*. They are: *rapax* (Comstock), *lataniae* (Signoret), *popularum* (Marlatt), *ignobilis* Ferris, *cupressi* (Cockerell), *diffinis* (Newstead), *candidula* (Cockerell), and *palmae* (Cockerell). The species *H. coniferarum* (Cockerell) is newly assigned having previously been placed in *Diaspidiotus* Berlese and Leonardi, by Ferris. A tenth species, *H. pseudorapax* McKenzie, was assigned to this genus by its author. Seven of the 15 species have been assigned to *Abgrallaspis*. Both these genera appear to be North American in origin.

Abgrallaspis was originally created for six species. Three of these occur in North America and were transferred from *Hemiberlesia* by Balachowsky. They are: *palmae* (Cockerell), *degeneratus* (Leonardi), and *cyano-phylli* (Signoret). The last named species was designated as the genotype. Balachowsky (1953) later reassigned *palmae* to *Hemiberlesia* and transferred four more North American *Hemiberlesia* species to *Abgrallaspis*, namely, *howardi* (Cockerell), *comstocki* (Johnson), *coloratus* (Cockerell), and *fraxini* (McKenzie).

A study of these species in the National Coccoid Collection revealed a complex centering about *A. howardi* as conceived by Ferris (1938). Usual morphological comparisons of slide mounted adult females failed to yield results, therefore, host transfer experiments were undertaken.

A population of "*howardi*" of Ferris was secured on *pachysandra*. A total of 2,700 individual crawler transfers were then made to 20 different host plants. These hosts had been chosen because a preliminary study indicated unusual character variation in specimens collected from them. Fourteen of the test hosts (largely ornamentals) were later found to be infested with 14 to 54 per cent of the transferred crawlers. These crawlers were allowed

to mature. Adult females were then collected and mounted for study.

Six host plant species were completely unacceptable to infestation by the transferred crawlers. Five of these were plum, pear, peach, apple, and pine. *A. howardi* was described from plum in Colorado, and later recorded from such hosts as pear, peach, and apple. A study of the species Ferris synonymized with *A. howardi* revealed the test population to be *A. townsendi* (Cockerell), which was described from an unknown host in Mexico, and later recorded from a long list of ornamentals primarily in the southern and eastern United States. This species is redescribed and the name revalidated. A table is presented showing the variations found in salient taxonomic characters of *A. townsendi* collected from 14 different experimental host plants.

Important variations in the size of the second lobes of *A. townsendi* were recorded. Second lobe reduction from three-fourths the length of the median lobes to mere hyaline points was observed. Specimens in the last category strongly resemble *Diaspidiotus ancylus* (Putnam). Aside from these second lobe variations, *A. townsendi* is a relatively stable species from the standpoint of host determined morphological variables.

Avocado was the sixth test host on which transferred crawlers would not develop. Long series of scales from this host are present in the National Collection. They were collected from avocado fruit in quarantine at Texas, from Mexico. This species, *A. perseus* Davidson, is described as new herein.

As here understood for North America, *Abgrallaspis* contains 13 species. Six were placed in this genus by Balachowsky, and seven by the writer. The last are: *flabellata* (Ferris) from *Hemiberlesia*; *quercicola* (Ferris) from *Hemiberlesia*; *mendax* (McKenzie) from *Hemiberlesia*; *oxycoccus* (Woglum) from *Aspidaspis* Ferris; *ithacae* (Ferris) from *Aspidaspis*; *perseus* Davidson as a new species; and *townsendi* (Cockerell) as a revalidated name.

A brief presentation of materials and methods utilized in the host transfer experiments is followed by a discussion of the structural characters used in this work. Descriptions of *Hemiberlesia* and *Abgrallaspis* are accompanied by keys and descriptions to all the species in North America. Figures of adult female pygidial characters and scale coverings are provided for all species considered in these two genera.

Microfilm \$2.75; Xerox \$5.20. 105 pages.

LYSOGENY IN ENTEROPATHOGENIC
ESCHERICHIA COLI SEROTYPES
0111:B4 AND 026:B6

(L. C. Card No. Mic 60-5360)

John Patrick Glynn, Ph.D.
University of Delaware, 1960

Supervisor: W. R. A. Bailey

Twenty strains each of 0111:B4 and 026:B6, enteropathogenic *Escherichia coli* serotypes, were examined for lysogeny by a modification of Fisk's method. Six of the

026:B6 strains and one 0111:B4 strain were shown to be lysogenic. The seven bacteriophages (phages) were temperate phages and the host range studies indicated that these were seven distinctly different phages.

The host ranges of the phages were with one exception, confined to the somatic group from which they were isolated. The exception, the phage isolated from 0111:B4 strain 15, had its host range entirely within the 026:B6 somatic group. This phage was named D-1 by the author. Since this phage D-1 possessed a suitable host range for attempted transduction of the B4 antigen from cells of 0111:B4 to cells of 026:B6, it was studied in more detail than were the other phages.

Phage D-1 was propagated by inducing the lysogenic strain 0111(15) to lyse using the ultraviolet treatment. Lysates containing 10^8 - 10^9 phage/ml were obtained routinely. This phage was thermo-labile, but lysates could be bacteriologically sterilized by Seitz filtration.

An extensive series of transduction attempts were performed using 0111(15) as the donor strain and 026(2) as the recipient. Initially, the emphasis was placed on obtaining a transduced 026 cell having a B4 antigen in place of the normal B6 antigen. Since all attempts to isolate an 026:B4 cell failed, attempts were made to transduce other traits. Transduction experiments designed to transduce motility and streptomycin were not successful.

The inability to obtain any transduced forms in the D-1 - 026(2) system, prompted the author to examine the system in more detail. It was observed that D-1 was able to form well defined plaques on 026(2) lawns, but high yields of free phage could not be obtained if 026(2) was used as the propagating strain. The apparent anomaly was resolved when it was discovered that phage D-1, cultivated on 026(2), had a burst size of only 36 particles per cell. With such a small burst size, one would not expect the accumulation of appreciable quantities of free phage during propagation experiments on broth.

The lysogenic rate for the D-1 - 026(2) system was determined. It was observed that the rate was much lower in this system (3.5% at 37°C), than had been reported for other systems (usually approximately 20%).

It was observed that the lysogenic rate could be altered by changes in temperature during the latent period. The temperature change had to be applied, however, during the early portion of the latent period. Under these conditions, the lysogenic rate at 20°C was 6.9% as compared with 0.8% at 45°C. One interesting observation was that the percentage of cells surviving infection was not influenced by temperature. This seemed to indicate that the temperature effect in this system was due to thermal inactivation of the phage DNA in potentially lysogenic cells. Lieb (1953) had made similar observation of the *E. coli* K12S - *Lambda* system.

If the temperature of the system was lowered in to 20°C prior to mixing the phage with the cells, the lysogenic rate was increased to 22.3%. This increase in the lysogenic rate was due to an increase in the percentage of cells surviving infection and an increase in frequency of lysogeny among survivors. The increase in lysogeny at 20°C as compared to 37°C was approximately 6-fold. This type of temperature effect on lysogeny had been reported for the P-1 - *Shigella dysenteriae* system by Bertani and Nice (1954).

Both types of temperature effects had not been previously reported to occur in the same system. This might be due to

the methods used to estimate the lysogenic rate, which were different in each system. In addition, the temperature change had to be applied much earlier in the latent period in this system, than in previously reported systems.

The effect of chloramphenicol on the lysogenic rate was determined for the P-1 - 026(2) system. Using 10 gamma/ml of chloramphenicol, the lysogenic rate was 14-17 per cent at 37°C. This represented a 10 fold increase in the lysogenic rate, and therefore was in agreement with values reported by Christensen (1957) and Bertani (1957) for other phage-cell systems.

Microfilm \$2.75; Xerox \$4.60. 86 pages.

THE EFFECT OF THE DISSOCIATION-ACTIVATOR SYSTEM ON MUTATION IN MAIZE

(L. C. Card No. Mic 60-6808)

Kuang Sing Hsu, Ph.D.
University of Missouri, 1960

Supervisor: M. G. Nuffer

An experiment was designed to determine the number and kinds of mutable loci which could arise through the operation of the *Ds-Ac* mutator system. The design especially favored the detection of mutation at those loci concerned with the production of high-amylose starch in endosperm. Most of the mutants recovered were of the stable recessive type which would not respond to *Ac*. One dominant mutant concerned with a morphological character was found among about 25,000 plants observed. The occurrence of reverse mutation was not clearly established. One endosperm mutant was found among about 23,000 gametes tested. This mutant was not involved in high-amylose production and its response to *Ac* was not clearly established. Eight seedling mutants concerned with chlorophyll production were found among about 17,500 gametes tested. They include one yellow, one yellow green, one virescent, and five albino mutants. Reverse mutation was clearly expressed on all. According to the criteria given, they were induced by the *Ds-Ac* mutator system.

Microfilm \$2.75; Xerox \$3.00. 56 pages.

NON-ALLELIC GENE INTERACTIONS IN A POPULATION OF MAIZE DERIVED FROM A CROSS OF TWO INBRED LINES

(L. C. Card No. Mic 61-453)

Angus Hillyard Hyer, Ph.D.
Iowa State University of Science and Technology, 1960

Supervisor: Lowell H. Penny

Investigations were conducted as to the nature of the gene action in the inheritance of four quantitative characters in a population of *Zea mays* produced by selfing to the F₄ generation a cross of two homozygous inbred lines. The characters studied were number of kernel rows, ear

length, ear diameter, and total seed weight. Four non-allelic gene interaction models were considered. These were the complementary, duplicate factor, multiplicative, and optimum number models.

Seven genetic variances and covariances were estimated for each character. From these estimated variances and covariances, several genetic ratios were estimated. The estimated ratios were compared to those expected based on nonepistatic models. By these comparisons, evidence was found for the presence of non-allelic gene interaction effects in all characters. The data for ear diameter and seed weight fitted the duplicate factor model fairly well indicating this type of gene action may have been operative in the inheritance of these two characters. No consistent fit of the data to any of the four non-allelic gene interaction models was found for kernel row number and ear length. Under the assumption of duplicate factor gene action being operative, the number of loci involved in the inheritance of ear diameter was estimated to be 2-8 and not over 32 and that for seed weight to be 2-32.

The conclusions reached in this study were based on several assumptions. Certain of the assumptions may not have been met. The most likely ones were symmetry of gene effects, the absence of linkage, and the absence of genotypic-environmental interaction. Nonvalidity of these assumptions could have caused serious bias in the results giving evidence for the presence of non-allelic gene interaction effects when such effects were not present.

Estimates of the average degree of dominance were obtained for all four characters. These estimates were obtained from a nonepistatic model. No evidence was found for overdominance.

The genetic variances and covariances estimated in this study were subdivided into components designated as σ_{yy} , σ_{y1} , σ_{y2} , σ_{11} , and σ_{12} . σ_{yy} is the genotypic variance of the F_2 generation, σ_{11} is a variance which is a measure of the dominance deviations, and σ_{y1} , σ_{y2} , and σ_{12} are covariances involving epistatic effects. Different estimates were made of these parameters and comparisons made of the estimates.

In order to evaluate the standard errors of the estimated genetic ratios, expectations of covariances of the form $Cov(Cov\ 1, Cov\ 2)$ had to be derived where $Cov\ 1$ and $Cov\ 2$ were estimated genetic variances or covariances. The method used in the derivation of these expectations was shown and the results reported.

Microfilm \$2.75; Xerox \$5.00. 97 pages.

CYTOGENETIC AND BIOCHEMICAL STUDIES OF THE ACTION OF A GENE CONTROLLING MEIOSIS IN MAIZE

(L. C. Card No. Mic 60-6327)

Sushil Kumar Sinha, Ph.D.
Indiana University, 1960

The ameiotic gene in maize has a drastic effect on the course of meiosis. The recessive allele (*am*) in the homozygous condition causes complete male sterility and almost complete female sterility. Occasionally, triploid kernels are formed from diploid eggs.

Cytological and genetic studies: In pollen mother cells of ameiotic plants meiosis is substituted by a mitotic division. It is characterized by an incipient pairing of homologues at prophase, a contraction of metaphase chromosomes and their alignment parallel to the equator, and a failure of cytokinesis.

Division of the megaspore mother cell is also mitotic. Instead of the basal or the chalazal megaspore giving rise to the embryo-sac, the diploid spore towards the micropyle undergoes a second mitotic division and presumably gives rise to the embryo-sac.

The genotypic constitution of diploid eggs arising from ameiotic plants heterozygous for the *Lg-2* and *A-1* loci in chromosome 3 was determined. The results confirmed the inference from cytological observation that diploid eggs are derived from mitotically dividing mother cells. There is no evidence of crossing over during the production of diploid eggs.

Biochemical studies: Paper chromatographic studies of free amino acids and sugars in vegetative and reproductive structures did not show any striking difference between normal and ameiotic plants. However, there is an abundance of a U. V. fluorescent (probably phenolic) compound in the vegetative and reproductive structures of ameiotic plants.

The *am* gene appears to cause a disturbance in the nucleic acid metabolism as is evident from the following results of biochemical studies with roots, ears, ovules and anthers.

In normal ears, precursors of nucleic acids are found only transiently in the premeiotic stage. In ameiotic ears large quantities of precursors are found at all times except at a very early stage in ear development. Maximum accumulation is found at the premeiotic stage. The degree of accumulation in ameiotic ears, ovules, and anthers at the premeiotic stage is about 2-3, 3, and 5-6 times as high, respectively, as that in the corresponding normal structures. This difference is observed whether the precursors are extracted with cold 2% perchloric acid (PCA) or with cold 5% PCA. The constituents of the cold 2% PCA soluble fraction from ears of both phenotypes were identified as adenosine, guanosine and uridine. Their relative amounts were, however, different in the two phenotypes. The cold 5% PCA soluble fraction (after extraction with cold 2% PCA) appears to contain ribonucleotides. In the ameiotic ears, the greatest accumulation of precursors above the normal values occurs in the micropylar region. No precursors are found in vegetative meristematic tissues such as root tips of both phenotypes.

Nucleic acids were extracted from different organs following the Ogur-Rosen procedure. In ears the results of this method were compared with those obtained with the Schneider method. Though the relative amounts of RNA or DNA vary, the RNA/DNA ratio is higher in ameiotic structures than in normal ones. The greatest difference between the RNA/DNA ratio of ameiotic plants and that of normal plants is in the root tips.

The relative amounts of three different fractions of RNA (one extracted with cold 2% PCA and called RNA-1, a second and major fraction extracted with cold 10% PCA and called RNA-2, and a third one not extracted with cold 10% PCA and called RNA-3) were estimated in anthers, in the cob, and in the micropylar and chalazal halves of the ovule. The maximum difference between the two phenotypes is found in the ratio of RNA-1/DNA. In normal ears,

the RNA-1/DNA ratio is highest in the cob and lowest in the micropylar half. The reverse is true in ameiotic ears.

U. V. absorption spectra of various nucleic acid fractions showed apparent differences between the two phenotypes in respect to (1) purine bases of DNA (liberated after a brief hydrolysis with 1N HCl) and (2) apurinic DNA. Chromatographic analysis of the first fraction shows a very high ratio of "epiguanine" (Hotchkiss) to guanine. The RNA (Ogur-Rosen) fraction from ameiotic ears shows a higher Py/Pu ratio than does the normal material.

The quantity of apparent histones seems to be higher in ameiotic ears.

It is concluded that the higher RNA/DNA ratio, the altered base composition of ameiotic RNA, and the bulk and composition of the nucleic acid precursor pool are somehow responsible for the failure of the onset of meiosis in ameiotic plants. It is postulated that the RNA/DNA ratio is an important factor controlling the inter-conversion of mitosis and meiosis. A high RNA/DNA ratio at prophase renders the pattern of division mitotic and a lower ratio makes it meiotic.

Microfilm \$2.75; Xerox \$5.80. 120 pages.

STUDIES ON ULTRAVIOLET-INDUCED MUTATION IN NEUROSPORA CRASSA

(L. C. Card No. Mic 61-526)

Tiliu Vaharu, Ph.D.
Syracuse University, 1960

It has been shown that conditions which favor protein synthesis, immediately following ultraviolet (UV) irradiation, cause a considerable increase in the number of induced mutants in bacteria (Witkin, 1956; Doudney and Haas, 1958; Schwartz and Strauss, 1958). Doudney and Haas (1958) have suggested that some intracellular "mutagen," produced by UV, has to be temporarily stabilized, and subsequently fixed, by ribonucleic acid (RNA) synthesis, and that these processes involve protein synthesis.

The purpose of this study was to determine whether protein synthesis following UV irradiation had a similar effect on the mutation frequency in Neurospora crassa.

A requirement for leucine was introduced into a colonial strain, and the reverse mutation to leucine independence studied. As the strain could not grow without an exogenous supply of leucine, it was assumed that the addition of leucine to the growth medium provided the conditions necessary for protein synthesis. Chloramphenicol and amino acid analogues were used to test the effects of inhibitors of protein synthesis. RNA derivatives were used to enhance RNA synthesis.

Appropriate control experiments were carried out to determine the effects of crowding on agar plates and to eliminate the possibility of selective killing of the conidia during the incubation period.

The results show that following UV doses sufficiently high to inactivate about 50 per cent of the conidia, addition of leucine to the incubation medium increased the induced mutation frequency (defined as mutants per survivors), while after lower doses the effect was reversed and mutation frequency was decreased by the addition of leucine. The effect of leucine was found to vary with the dose of UV in both directions, that is, the higher the dose, the greater the increase in mutation frequency, and the lower the dose, the greater the decrease. Conditions which are inhibitory to protein synthesis (chloramphenicol, amino acid analogues and suboptimal temperature) were found to counteract the action of leucine, suggesting that the effect of leucine was due to protein synthesis. The results also suggest that RNA synthesis, following low doses of UV, increased the mutation frequency. The sensitive period (time following irradiation after which the addition of leucine was still effective in modifying the mutation frequency) was found to increase with the dose of UV, suggesting that the metabolic process(es) responsible for modifying the mutation frequency had to occur before the termination of UV-induced lag in deoxyribonucleic acid synthesis.

The important difference between the results obtained in this study and those reported for E. coli lies in the fact that in these experiments protein synthesis after low doses of UV decreased the mutation frequencies, while only increases have been observed in E. coli.

It is suggested that the observed differences between the effects of protein synthesis on the mutation frequencies after high and low doses of UV may be explained in terms of the differences in the inhibitory effects of different doses of UV on the synthetic processes of cells.

Microfilm \$2.75; Xerox \$5.60. 112 pages.

BOTANY

BIOCHEMICAL AND CYTOLOGICAL CHANGES IN THE DEVELOPING SOYBEAN COTYLEDON

(L. C. Card No. Mic 61-86)

Robert Frederick Bils, Ph.D.
University of Illinois, 1960

This investigation incorporates the physiology, biochemistry, histology and cytology of the immature, devel-

oping soybean cotyledon from about 1 mg fresh weight to maturity. Following standard manometric techniques, rates of oxygen uptake of whole seeds, cotyledons and seed coats and rates of oxidation and phosphorylation of mitochondrial preparations were measured. Protein fractionation studies were also carried out at various stages of development. Cotyledons were fixed in FPA or in Carnoy's fluid and stained sections were studied and photographed with the light microscope. Safranin-fast green stain, the periodic acid-Schiff reaction, amylase, I₂KI and arginine

tests were run on these sections in the histochemical analysis of the developing cotyledons. Cotyledon slices were also fixed and embedded for electron microscopy.

The development of the soybean cotyledon from 1 mg fresh weight to maturity can be divided into five periods according to the major changes taking place: I. 15 to 20 day (1 to 75 mg fresh weight; II. 20 to 26 day (75 to 150 mg); III. 26 to 36 day (150 to 280 mg); IV. 36 to 52 to 57 day (280 to 480 to 380 mg); V. 57 to 60 day (380 to 180 mg).

Throughout the first period, the cytoplasm is composed mainly of many RNP granules, proplastids, eventually mitochondria and a few mitochondria. The rates of oxygen uptake of the whole tissue and the mitochondrial preparations are high compared to later periods. Total lipid and protein increase is moderate compared to a similar period a week later. Considering that cell division is infrequent beyond 14 days after flowering and that further growth is mostly due to cell enlargement, the 26-day cells are each synthesizing much more actual lipid and protein per day than the 16-day cells. The cells of this first period seem to be synthesizing precursors to the mitochondria, immature chloroplasts and other cytoplasmic components seen in the next period.

The second period of development, typified by cells 22 days after flowering, appears to be a time of high metabolic activity. Fresh and dry weights are increasing rapidly as the cytoplasm is undergoing many changes. Many mitochondria are seen, to account for the relatively high respiration rates of the whole tissues and the mitochondrial preparations. The energy produced during this period is probably used for subsequent lipid and protein synthesis. A few protein globules appear, and the number of lipid granules increases slightly. A number of starch grains are seen at this time and seem to persist almost to maturity.

A great increase in the size and number of protein globules is evident during the third period (26 to 36 days after flowering). Since the total protein increases slowly and uniformly during development, and the protein globules or storage protein increases rapidly, it may be inferred that total protein must be separated into active or metabolic protein and inactive or storage protein. Since cellular components consisting of lipoprotein or nucleoprotein are almost non-existent in the 30- or 36-day cotyledon tissue, the amount of metabolic protein must decrease. This period also includes the time of rapid lipid synthesis.

About a six- to eight-fold increase in cell volume is seen during this third period, as the dry weight of the cotyledons increases from about 3 to 75 mg. This cell enlargement is in contrast to the many cell divisions occurring in the hypocotyl throughout development.

In the fourth period the respiration rate of the cotyledon tissue is low. The period is characterized by a steady increase in the lipid component. A greater increase is seen in the storage protein which can be correlated with the increase in the protein of the soluble fraction in the fractionation study. The starch grains are present throughout this period, possibly decreasing in number toward 57 days after flowering. The cells continue to increase in size as the fresh and dry weights reach a maximum (about 52-day). At about 57 days, dehydration of the seed is taking place rapidly.

Starch grains appear to have been quickly and completely converted to other components, since none are seen at maturity. Dehydration and maturation is completed

during this fifth and final period of development. The moisture content and respiration rate of the mature seed are quite low. Lipids account for about 22% of the dry weight of the cotyledon; proteins for about 50%. It can be seen from the protein fractionation study that over 80% of this protein is in soluble form.

The mature cotyledon at 60-days, then, is a virtual storehouse of energy to be used at the time of germination. The vascular tissue seen throughout the development of the cotyledon is important in the movement of food to the hypocotyl during germination. The rapid utilization of lipid and especially protein in germination is seen in a cell of a two-day germinated cotyledon. Only a few protein globules are seen in the cells, thus demonstrating their role in germination and their importance as storage material.

Microfilm \$2.75; Xerox \$4.00. 74 pages.

THE PLANT ECOLOGY OF BRYCE CANYON NATIONAL PARK

(L. C. Card No. Mic 60-6223)

Hayle Buchanan, Ph.D.
University of Utah, 1960

Chairman: Walter P. Cottam

Management policies of the National Park Service were initiated in Bryce Canyon National Park thirty-two years ago, with the objective of preserving the biota in a primitive, natural condition, but no inventories of the biological communities were taken. The purpose of this investigation was to provide a quantitative and qualitative report on the condition of the present plant communities of the park, together with an appraisal of the environmental factors that support them. An evaluation of the effects of the policies of the National Park Service on the plant communities of the park was made.

The vegetation of the park was separated into six major types, as follows: foothill forest of pinyon-juniper, "breaks," submontane forest of ponderosa pine, sagebrush openings, dry meadows of grasses-sedges, and montane forests of spruce-fir. A complete list of the plants collected was included along with an indication of the distribution of each plant in the six vegetational types.

An analysis of climatic and edaphic factors of the environment was undertaken to gain an understanding of the present distribution and condition of the plants of the park. Eleven temporary climatic stations, equipped with instruments for measurement of air temperature, precipitation, evaporation, soil temperature, and soil moisture, were established within the park to supplement climatic data from five stations of a more permanent status. Station areas were selected to represent typical plant communities. Soil samples from each location were collected and analyzed to determine mechanical fractions and pH.

The great diversity of topographical features of the park is reflected in great differences in climate. Air drainage phenomena prevent the establishment of forests near intermittent stream channels of the Paunsaugunt Plateau.

To accomplish the quantitative and qualitative investigation of the present plant communities of the park, several modern methods of ecological study were applied.

A series of connecting and supplementary permanent transect lines were established to sample the vegetational communities. The quarter method of tree study was applied at 240 points along the transects in forest communities to obtain data on the frequency, density, and dominance of trees, saplings and seedlings. Vegetational study plots were established at 315 points on the transect lines to obtain similar data for species of undercover. The data formed the basis for application of two ordinate techniques, the uni-dimensional continuum and a bi-dimensional ordination. The "gradient analysis" approach to the study of continuously varying vegetation was applied to the data on the basis of elevation, direction of slope, and degree of slope. This resulted in division of the vegetation into thirteen communities. Each species of tree was assigned an environmental coefficient, based upon an estimation of moisture requisites and temperature tolerances, which was used to obtain continuum index values for comparison of communities. Many environmental relationships, species interrelationships, and community differences were indicated by the bi-dimensional ordination.

The basic policies of the National Park Service were reviewed and evaluated on the basis of the outcome of management activities in the park.

Some recommendations regarding management policies of the National Park Service, as a result of this evaluation, are as follows:

1. Application of careful silvicultural practices to the forests of the park to minimize damage from insects and plant parasites.
2. More discrimination in the use of chemical agents of control of insects and tree diseases.
3. Immediate effective reduction of the present overpopulation of mule deer.
4. Effective control of populations of porcupines.
5. Complete elimination of grazing from all land within the park.

The present study should be regarded by the National Park Service as the initial phase of a long-range ecological investigation to obtain evidences of changing conditions and trends. Microfilm \$2.75; Xerox \$7.00. 147 pages.

EXPLORATORY STUDIES OF TEXAS SOIL ALGAE

(L. C. Card No. Mic 60-6610)

Temd Robert Deason, Ph.D.
The University of Texas, 1960

Supervisor: Harold C. Bold

This dissertation summarizes investigations of the algal flora in soils of the Carrizo Sands, Caldwell County and of Williamson County, Texas. From approximately 400 isolates, 20 organisms are discussed, of which 18 are described as new species, two of them typifying new genera. The organisms comprising the last group have been established in bacteria-free condition and type cultures have

been deposited in the Culture Collection of Algae, Indiana University, Bloomington, Indiana. The organisms described herein for the first time are:

CHLOROPHYCEAE

Chlamydomonas actinochloris sp. nov.
Chlamydomonas radiata sp. nov.
Chlamydomonas akinetos sp. nov.
Chlamydomonas pyrenoidosa sp. nov.
Chlamydomonas aggregata sp. nov.
Chlamydomonas appendiculata sp. nov.
Chlamydomonas typica sp. nov.
Chlorococcum ellipsoideum sp. nov.
Chlorococcum rugosum sp. nov.
Chlorococcum intermedium sp. nov.
Neochloris pseudoalveolaris sp. nov.
Spongiococcum multinucleatum sp. nov.
Spongiococcus lamellata sp. nov.
Chlorosarcinopsis texensis sp. nov.
Hormidium sterile sp. nov.
Pseudoschizomeris caudata gen. et sp. nov.
Pleurastrum erumpens sp. nov.

XANTHOPHYCEAE

Pseudobumilleriopsis pyrenoidosa gen. et sp. nov.

As an aid to taxonomic characterization, special attention was devoted to wall organization and composition in several selected species, and to devising techniques which would provide additional taxonomic criteria, other than morphological. The data obtained have, in fact, helped to clarify the classification of several groups of soil algae.

Although the determination of the genera of the spherical, unicellular Chlorococcales has been facilitated by the establishment of reliable criteria by Starr (1955), the determination of species by exclusively morphological attributes remains difficult. The writer has investigated attributes other than those strictly morphological, including colony characters, color of two-month-old cultures on standard media, cell wall structure and composition, sensitivity to antibiotics, growth in differential media, and motility (in the case of the genus *Chlamydomonas*).

The supplementary attributes found useful for identifying chlorococcalean algae were employed also in the studies of volvocalean, ulotrichalean and xanthophycean organisms described in this dissertation.

Microfilm \$2.75; Xerox \$6.60. 137 pages.

POLLEN PROFILES FROM FIVE BOG LAKES IN NEW YORK STATE

(L. C. Card No. Mic 61-506)

LaVerne Harry Durkee, Ph.D.
Syracuse University, 1960

Supervisor: Mildred E. Faust

The sediments of five bog lakes in New York State were sampled and statistically studied for the relative proportions at different levels of pollens from nineteen tree

genera. These bog lakes were sampled over water at their deepest points. Two lakes--the Devil's Dye-Tub near Tully and Hidden Lake near Pennellville, New York--were sampled through ice with the Davis sampler. The other three lakes--Little Punky Pond near Chase's Lake, Eskar Pond near Wanakena, and Porcupine Pond near Loon Lake--were sampled over open water with the Hiller borer.

Mirror Lake, one of the Tully Lakes, was also sampled but the operation was discontinued after it was found that the Davis sampler could not penetrate to the true bottom. The sediment sampled revealed high percentages of hemlock and beech pollens, indicating that they were deposited during a warm, moist period. It was concluded, therefore, that the sediments of this lake are considerably deeper than the fifty-six feet measured.

Five major vegetational changes were observed in all the pollen profiles. The chief indicators were as follows: spruce and fir--a cold, moist climate; pine--a warmer and drier climate; hemlock and beech--a warm, moist climate; pine and oak--a warm, dry climate (maximum warmth). Two *Tsuga maxima* were observed for each profile with a period of maximum warmth appearing between these two maxima. This substantiates earlier work done on bogs in New York State. The second *Tsuga* maximum which occurs near the upper portion of each profile is interpreted as a return of cooler and moister conditions. In the more northern profiles, this *Tsuga* maximum was followed by increases of spruce and fir pollens.

The distribution of pine pollen size frequencies was plotted for each profile. It was observed that the greater percentage of pine pollen under forty-one microns in length was present in the lower third of each profile, concurrent with the highest percentages of pine. It was concluded that this was due primarily to *Pinus banksiana* since the pollen grain of this species measures 31-41 microns in length while that of *P. strobus* and *P. resinosa* are considerably larger.

Microfilm \$2.75; Xerox \$4.00. 72 pages.

A BIOSYSTEMATIC STUDY OF THE PHLOX CUSPIDATA-PHLOX DRUMMONDII COMPLEX

(L. C. Card No. Mic 60-6615)

Lawrence Wayne Erbe, Ph.D.
The University of Texas, 1960

Supervisor: B. L. Turner

A biosystematic study was made of the *P. cuspidata*-*P. drummondii* complex. Emphasis was placed on field studies and experimental breeding. Chromosome counts were made from bud material collected from 50 populations representing all the taxa. All meiotic counts were $n = 7$. The karyotype of *P. drummondii* var. *mcallisteri* was worked out. Distributional and ecological information was gathered and generalized maps showing the distributions were made. Kodacolor prints of the flowers of the various taxa are included.

Populations of hybrid and/or introgressed nature were noted. Three populations were analyzed using the scatter diagram technique of Anderson. One of these, a hybrid

population, showed a "recombination spindle" and supported the belief that the population was of hybrid derivation. "Pure" populations of the putative parental types were analyzed by the same technique.

A total of 471 flowers were emasculated and pollinated; 21 of these crosses involved *P. roemeriana* as the pollen parent. Breeding cages were utilized in the study. *P. drummondii* var. *littoralis* showed a low degree of self-fertility. *P. cuspidata* var. *humilis* was highly self fertile. The other taxa did not set any seeds by selfing within the cages. The over-all average of normal-appearing seeds produced, as compared to the number theoretically possible, was 57 percent. Although 747 seeds of normal appearance were obtained from the crosses within the *P. cuspidata*-*P. drummondii* complex, efforts to germinate these seeds proved fruitless.

A brief systematic review is presented and a key to the annual taxa of *Phlox* is included. The author recognizes two species within the *P. cuspidata*-*P. drummondii* complex. Two varieties, *cuspidata* and *humilis* are recognized within the species *P. cuspidata* and six varietal taxa are included within *P. drummondii*. Two subspecies are recognized in the latter species, in order to show more closely the degrees of relationship. Subspecies *glabriflora* includes var. *glabriflora* and var. *littoralis*. Four varieties, *drummondii*, *mcallisteri*, *goldsmithii* and *tharpai* are included within ssp. *drummondii* in order to show their rather close relationships. Three new varietal combinations were made in order to conform with the treatment.

Microfilm \$2.75; Xerox \$5.20. 104 pages.

FACTORS IN CORN STEEP WATER PROMOTING GROWTH OF PLANT TISSUES

(L. C. Card No. Mic 60-6290)

Juan Eugene Fox, Ph.D.
Indiana University, 1960

In an effort to culture tissues of the cocklebur, *Xanthium pennsylvanicum*, it was determined that continuous growth of callus tissue derived from the cambium could be obtained only when corn steep water, a by-product of the corn starch refining industry, was added to a basal medium containing mineral salts, vitamins, glycine, sucrose, indoleacetic acid, and kinetin. A program to isolate and characterize the growth-stimulating components was carried out.

The active substances seem to be something other than any growth factor for plants so far described. Evidence was presented to show that the active compounds in corn steep are not auxins of the indoleacetic acid variety nor kinetin or a kinetin-like substance. Cocklebur tissue has a well defined requirement for an active fraction of corn steep, an added auxin, and kinetin. Growth does not occur if any of these are missing from the medium. Indoleacetic acid, indolebutyric acid, and naphthaleneacetic acid will all satisfy the auxin requirement; the last named is the most effective. 2,4-dichlorophenoxyacetic acid is inhibitory.

Corn steep water was separated into two fractions synergistic for the growth of cocklebur with activated charcoal. Subsequent experiments showed that one of

these fractions could be replaced by a mixture of potassium, nitrogen, and phosphorous which cocklebur tissue requires at extraordinarily high levels.

The other fraction is inactive upon ashing and is probably organic. It is stable to heating in acid and base and readily dialyzable across a collodion membrane. The active substance is highly water soluble and only very slightly soluble in organic reagents. The active compound is, therefore, probably not one of the fatty acid ester growth stimulators and is probably not a gibberellin-like substance. The active material in the corn steep is not precipitated with silver or barium; it is, however, brought out of solution with mercuric acetate and for this reason is probably a nitrogenous compound. The stimulatory substance in corn steep water is held on a column of Dowex-50 cation exchange resin if put on under acid conditions and can be brought off with concentrated ammonium hydroxide. Approximately a hundred fold purification of the steep water has been achieved with no appreciable loss in activity. More work is needed, however, to achieve the degree of purification necessary for characterization of the active compound.

Substances which are presumably identical to the corn steep factor have been extracted from wheat germ, corn syrup, peanut meal, and fresh corn. The presence of the corn steep factor in materials from so diverse an origin makes it very likely to be a naturally occurring plant product rather than a chemical artifact produced during the fermentation of the corn steep.

A great number of known compounds have been tested for their ability to replace corn steep in the culture of cocklebur tissue, but no known compound so far tested has shown activity. It is clear that the active material is not a free sugar, a purine, a lipid soluble substance, a protein, an inorganic compound, nor any of the ordinary vitamins or plant growth promoting substances. Further experimental work is required for the isolation of the corn steep factor. Microfilm \$2.75; Xerox \$5.40. 107 pages.

A COMPARATIVE PALEOBOTANICAL INVESTIGATION OF THE INDIANA AND RUSSIAN PAPER COALS

(L. C. Card No. Mic 60-6293)

Gottfried Kurt Guennel, Ph.D.
Indiana University, 1960

A coal exposed in the highwall of a strip mine near Nyesville, Parke County, Indiana has a high cuticle content. The upper six inches are sheet-like and papery in appearance. The only other known coal of a similar type is that reported from the Moscow Basin of Russia in 1860 by Auerbach and Trautschold.

In order to ascertain whether the designation "paper coal" is appropriate for the Indiana coal, a study of the Russian *Papierkohle* was made. A review of the literature revealed that a number of misconceptions exist concerning the nature and extent of this coal. Although the Moscow Basin covers an area of more than 30,000 sq. km., the coal seams are discontinuous lenticular deposits, and the *Papierkohle* is restricted to the upper part of a lignitic coal. Paper coal has been reported at only four outcrops

in the Moscow Basin. The thickness of the papery layer does not approach the massiveness claimed by some authors, but instead ranges between 1.2 and 10.0 cm.

Examination of a sample of the Russian coal revealed that the cuticles represent young stems of two arborescent lycopods, *Lepidodendron* and *Bothrodendron*, which are represented by three species each. The coal-bearing rocks of the Moscow Basin rest on Lower Carboniferous limestones, and are presumed to be overlain by other Lower Carboniferous marine strata.

The results of palynological investigations indicate that the Indiana paper coal and associated rocks belong to the Brazil Formation (late Pottsville) of Pennsylvanian age. The paper coal is identified as belonging to the Upper Block b zone. Weathering and leaching account for the papery appearance of the coal where it is exposed. Even the non-papery portion of the paper coal seam is high in exinite (15.8 and 7.7 percent respectively of cutinite and sporinite) and volatile matter (59.8 percent), but low in vitrinite (24.1 percent). The cuticle accumulated *in situ*. Intermittent interruptions of the decomposition cycle are given as reason for the preservation of the cuticle.

Fifty-seven miospore species are described and illustrated, including two new species. Two new macrospore species, *Cystosporites saccatus* and *Macroflorinites ovalis*, are also described. The problem of *Torispora-Bicoloria* is discussed, as both (miospores and sporangia) are abundant in the Indiana paper coal. The recommendation is made to restrict the name *Bicoloria* to the sporangia and the name *Torispora* to isolated, dispersed spores. For the alete, membraneous spores, when found as *spores dispersae*, the name *Vagospora balmei* is proposed.

The abundant leaf and stem cuticles of the Indiana paper coal are assigned to *Sphenopteris cuticularis*, a new pteridosperm species. The compound leaves are estimated to have attained a length of three feet and were hirsute and clinging, as evidenced by the presence of numerous trichome openings and spiny tips.

Seed membranes assignable to *Pterospermatites* (*Spermatites*) *reticulatus* and *P. obovatus* sp. nov. are thought to be derived from plants transitional in type of seed development between those of the *Lyginopteridaceae* and *Medullosaceae*. Fibrillose tips, tentatively identified as fructifications, are thought to belong to *Sphenopteris cuticularis* and are described as *Strobilites indianensis* sp. nov. Microfilm \$5.45; Xerox \$19.15. 425 pages.

A STUDY OF ERYSHIPHE CICHORACEARUM DC. EX MERAT ON DETACHED LEAF CULTURE.

(L. C. Card No. Mic 60-6309)

Ralph Michael Morrison, Ph.D.
Indiana University, 1960

Erysiphe cichoracearum DC. ex Merat is an obligate parasite attacking a number of genera in the *Compositae* and in the *Cucurbitaceae*. Before any detailed study of this organism could be made, it was necessary that a culture method be utilized which would minimize both biological variation as well as environmental variation. The following abstract represents the results obtained from a study of the mildew on such a culture.

The optimum temperature for maintenance of the leaf disk tissue of the three species of host plants used and for the growth of *Erysiphe cichoracearum* was found to be 18 to 20 degrees centigrade. Both leaf disks and the infecting mildew colonies did well under conditions of high relative humidity. However, condensation of water on the surface of the leaf disk tissue prevented germination of conidiospores, as well as causing an established colony to cease growth. An intensity of 300 to 400 foot candles of illumination was favorable for both host tissue and the infecting mildew colony. The two-membered cultures were maintained under an eighteen hours light to six hours dark photoperiod.

The germ tubes of conidiospores of *Erysiphe cichoracearum* were unaffected by unilateral illumination. Light stimulated spore germination at low temperatures. The highest percentages of conidiospore germination were obtained at 18 to 24 degrees centigrade. There was little germination of conidia below 10 degrees and no germination at 32 degrees.

High relative humidities increased the germination of conidiospores when compared with lower percentages of germination of spores maintained in dry atmospheres. *In situ* germination of conidia occurred in leaf disk culture.

Leaf disks maintained with or without the addition of kinetin have proved an effective means for the culture of *Erysiphe cichoracearum*. Forty-four clonal isolates of *E. cichoracearum* from *Helianthus annuus* L., *Xanthium pennsylvanicum*, Wallr., and *Zinnia elegans*, Jacq, which were grown by this method, failed to produce cleistothecia. However, intercrossees between these clones resulted in cleistothecial formation in three to five weeks. The crossing data confirmed heterothallism in *E. cichoracearum* and established the presence of two compatibility factors in this organism. With several exceptions, isolates from *Helianthus*, *Xanthium*, and *Zinnia* were fertile with one another. These exceptions, confirmed by repeated matings, suggested that there are two allelomorphic series in *E. cichoracearum* which control the compatibility of single conidium clones isolated from different host plants and the host specificity of these clones.

Ascospores have been obtained in culture six to seven weeks after the mating of compatible clones. Attempts to germinate these spores and others from nature and to infect susceptible host plants have not been successful.

During the course of clonal isolation and crossing, a number of cross inoculations were performed. Clonal isolates taken from one host plant were inoculated on leaf tissue from another species of host plant. All the clones, isolated from the three species of host plants, grew on the *Helianthus annuus* tissue. The *Zinnia elegans* clones showed very little compatibility for the *Xanthium pennsylvanicum* tissue; the *X. pennsylvanicum* clones had little affinity for the *Z. elegans* tissue. These data suggest that clones of *Erysiphe cichoracearum* isolated from different host plants have been separated into specific physiological races.

Microfilm \$2.75; Xerox \$4.80. 91 pages.

GROWTH AND TRANSLOCATION DURING THE AFTER-RIPENING OF SEEDS WITH RESTING EMBRYOS

(L. C. Card No. Mic 60-5368)

Harvey Omar Olney, Ph.D.
University of Delaware, 1960

Supervisor: B. M. Pollock

Seeds of the sour cherry, *Prunus Cerasus* L. var. Montmorency, and the spice bush, *Lindera benzoin* Blume were after-ripened at 5°C (at which temperature rest is broken) and at 25°C (at which temperature rest is not broken). Measurements were made directly upon the embryonic growing regions at intervals during the after-ripening period using micro methods. The germination of whole seeds and growth capacity of excised embryos were also measured.

In cherry seeds during after-ripening at 5°C the embryonic growing regions grew as shown by increases in linear dimensions and cell number. Total nitrogen was translocated from the cotyledons at a rate sufficient to maintain a constant amount of nitrogen per cell. Phosphorus, however, was translocated at a higher rate, resulting in an increase in the total quantity per cell during the after-ripening period. High and low-energy nucleotide phosphorus and acid insoluble phosphorus (nucleic acids and nucleoproteins) increased, while acid soluble phosphorus (sugar phosphates) and inorganic phosphate showed little change. Growth capacity increased steadily from the fourth week of after-ripening.

In cherry seeds after-ripened at 25°C little or no growth took place in the embryonic growing regions following an initial burst of cell divisions in the leaf primordia which also occurred at 5°C. No nitrogen was translocated from the cotyledons. Total phosphorus increased slightly in the leaf primordia from the twelfth to the sixteenth weeks of after-ripening. Acid soluble phosphorus increased during the first four weeks of after-ripening and then decreased. Inorganic phosphate increased sharply from the fourth to the eighth week and then decreased. Low-energy nucleotide phosphorus increased slightly along with a slight rise in growth capacity. In the phosphorus fractions measured, seeds after-ripened at 5°C were higher than those after-ripened at 25°C except in the inorganic and acid soluble (sugar phosphate) fractions, where the order was reversed from that expected.

Following an initial burst of cell divisions at both 5°C and 25°C no further increase in cell number or length took place in *Lindera* embryonic axes. A slight rise in high-energy nucleotide phosphorus occurred during after-ripening at 5°C, but no other significant changes were noted.

In the investigation cherry seeds from two years crops, stored in different ways, were used. The total phosphorus content and changes during after-ripening differed by almost 100% between these two crops. This type of difference between seed crops has not been previously noted.

Microfilm \$2.75; Xerox \$5.00. 96 pages.

THE WILD AND CULTIVATED PANDANUS
OF THE MARSHALL ISLANDS

(L. C. Card No. Mic 60-5332)

Benjamin Clemens Stone, Ph.D.
University of Hawaii, 1960

The Marshall Islands, a group of atolls in the Micronesian area of the Pacific Ocean, have in common a low elevation rarely more than a few feet above sea level, a derivation from coral marine organisms, and a native flora very poor in species. One of the more important members of the terrestrial flora is the genus Pandanus, found in the Marshalls on nearly every islet, over a wide range of habitat variation. Only one section of the genus, the typical one, is present, but more than twenty species had been reported for the area. Many of these species were known only from one collection, and their distinguishing features were poorly recognized. It had been realized for some years that the Marshallese people relied heavily on Pandanus fruit for food, especially in times of drought. The extent of cultivation practiced, however, had escaped the attention of most botanists. Field observations confirmed the view that the cultivated plants were vegetatively propagated clones, maintained by the Marshallese, bearing Marshallese names, and important in the Marshallese culture. The native taxonomy of Pandanus was surveyed and over 130 cultivars were found to have Marshallese names. An intensive field study of these plants, with ample collections for the herbarium, revealed that most of the species described earlier from the Marshalls were in fact different cultivars. Morphological studies indicated that three species were present, and that extensive hybridiza-

tions might be involved. Attempts to elucidate the nature of the variation from a cytological or genetical point of view failed for lack of material, but it seems entirely possible that genetic changes involving polyploid series and perhaps parthenocarpic reproduction may occur. A revision of the taxonomic classification of the Marshallese species disclosed that the cultivars could be included in one of two species, Pandanus pulposus (Warb.) Martelli, or Pandanus carolinianus Martelli. A third species is present but seems very rare; it is a hybridized variety of Pandanus pedunculatus R. Brown, and apparently derives from a Melanesian source. In the systematic treatment, a number of new taxa are described, all lower than specific rank, and many new combinations are made. The cultivars are described, named, and grouped under the most appropriate form whenever determination is possible. In all, 45 cultivars are described. An index to all the cultivar names, together with their derivation when known, and their distribution by atoll, is included.

It is hypothesized that the variation in the Marshallese populations of Pandanus is at least partly explained by assuming that hybridization is common. However, other factors may play an important role.

The use of Pandanus fruit as food is found elsewhere only in a few adjacent areas, particularly in the Gilbert Islands, and in Kapingamarangi, Mokil, Pingelap, and Ngatik Atolls. Cultural methods of preparing food from Pandanus differ, but most include at least one preparation which will keep for several months or years. This fact, plus the pro-vitamin A provided by Pandanus fruit, accounts in part for its importance in Pacific atolls.

Microfilm \$3.45; Xerox \$12.15. 268 pages.

CHEMISTRY

CHEMISTRY, GENERAL

FRENCH SUCCESSORS TO LAVOISIER AND THEIR DEVELOPMENT OF THE CHEMICAL REVOLUTION, 1789-1871.

(L. C. Card No. Mic 60-5948)

Jane Woodward Alsobrook Miller, Ph.D.
Tulane University, 1960

Chairman: John M. Scott

Chemistry as a science was born in France. Lavoisier, by combining his great talent as a laboratory technician with his ability to develop theories from the facts he discovered, raised chemistry from an art to a true science. The followers of Lavoisier felt that they were called to cultivate chemistry and that France, because of her position in Europe, should serve as the center in the development and propagation of the new science. The years 1789-1871 might be called the golden age of French chemistry, yet the nineteenth century saw a gradual decline in French influence in the world of chemistry.

In France, more than in any other country, the history of science is allied to the political and social history of the nation. The Revolutionaries had a great respect for science and drafted scientists into governmental positions. The Napoleonic policy of centralization led to the concentration of scientific endeavor through the educational system and the enormous power exerted by the Academy of Sciences. The constant changes in French governments and governmental policies led to tension and instability, which permeated all scientific circles. The Revolutionary and Napoleonic wars resulted in an acute shortage of chemists during the second decade of the century.

It was in France that chemistry was first applied to industry on a scientific basis. The economic development of the country played an important role in the history of chemistry. French scientists became industrialists, but a distaste for the regulated, often monotonous research required by industry prohibited the formation of industrial laboratories. Although France experienced an industrial revolution, it did not reach full development because of governmental instability, lack of natural resources, and a scarcity of trained technicians.

The French educational facilities of the nineteenth century, from the primary schools to the institutions of higher education, were inadequate. A constant struggle for control between the clerics and the state and France's unstable treasury led to a chaotic situation. The Revolutionaries did introduce the study of science into the educational system, however they failed to provide any means for scientific research. The chemists were forced to establish teaching laboratories at their own expense. There was in France no true university, higher education falling within the province of the professional schools or taking the form of popular lectures. The educational sys-

tem of France was constantly under governmental control. There was little freedom of teaching, and the political beliefs of the professors often affected their positions.

A detailed study of the scientific societies, the scientific periodicals and the schools of higher education illustrates the peculiar characteristics of French chemistry during the nineteenth century.

France produced many great chemists during this period. Their skill as analysts was unequalled. The majority, however, were content only to produce laboratory research without any attempt to develop theories or adopt new ideas concerning the constitution of compounds. Equivalent notation persisted in French journals and tests throughout the nineteenth century. Some less conservative chemists formulated theories based on laboratory results, but there were few who approached this science on a primarily speculative basis. The low academic salaries combined with the centralization of the schools of higher education and the great influence of the Academy of Sciences led to a concentration of power in the hands of a few men, who became virtual masters of French science. The enormous influence of these scientists played an important role in the development of French chemistry.

The biographies of representative Frenchmen illustrate the ideas and research prevalent in the nineteenth century. Andre Marie Ampère, whose fame rests primarily in his development of physics, was interested in chemistry. Since he was a theorist, his work left little mark on the ideas of his day, but his concept of the relation of molecules and atoms, his clarification of ideas concerning the halogens, and his classification of the elements are important additions to chemical literature. Marc Antoine Gaudin, another theorist, through his vision of the architecture of the world of atoms, solved various problems concerning the atomic theory, the study of mineralogy, and the constitution of organic compounds. His correspondence with Joseph Henry, first secretary of the Smithsonian Institution, shows his constant struggle for recognition. Two of the most influential men in nineteenth century France were Louis Jacques Thenard and Jean Baptiste André Dumas. Both held high governmental and academic positions. Thenard was the more conservative, but his ideas on esterification and catalysis led to important developments. Dumas was an outstanding professor and a leading participant in the polemics characteristic of the formative years of organic chemistry. Theophile Jules Pelouze, a contemporary of Dumas, also had great influence over French chemistry in the schools and through his text books. His important contributions to chemical literature have been neglected by historians. Although most research originated in Paris, there were many chemists active in the departments. Victor Dessaignes, a tax collector at Vendôme, was the discoverer of many new compounds, and the names he bestowed upon several organic substances are universally adopted.

Since Germany became the most influential nation in the development of chemistry during the later part of the

nineteenth century, a comparison of the French and German situations serves to delineate the causes of the decline of French influence. The instability and tension of France compared to the energy and purpose of Germany, France's incomplete industrial revolution compared to Germany's enormous economic progress, and the inadequacies of the French educational system compared to the great German universities, characterized by freedom of teaching, love for research, and well equipped teaching laboratories, explain the predominance of Germany and her chemists.

Microfilm \$3.70; Xerox \$13.05. 286 pages.

**SPECTROPHOTOMETRIC DETERMINATION
OF PALLADIUM(II) WITH
5(p-DIMETHYLAMINO BENZYLIDENE) RHODANINE**

(L. C. Card No. Mic 60-6651)

Banarsi Das Narang, Ph.D.
The University of Texas, 1958

Supervisor: Gilbert H. Ayres

A very sensitive spectrophotometric method has been developed for the determination of palladium, using 5(p-dimethylaminobenzylidene) rhodanine reagent and formic, hydrochloric, or propionic acid as solvents. The systems conform to Beer's law. The specific absorptivity is within the limits 0.38 to 0.40 per p.p.m.-cm. in the different solvents. The optimum range of palladium is about 0.4 to 2.5 p.p.m. for 1.00 cm. optical path. At higher concentrations of palladium a violet-red precipitate forms within a few minutes.

By using propionic acid solvent, maximum color is attained at room temperature in 10 to 15 minutes, and is stable for more than two hours. The system is sensitive to hydrogen ion concentration; maximum absorbance and stability are attained at 0.01 M hydrochloric acid in the final solution.

Platinum(IV), ruthenium(III), iridium(III), iron(III), chromium(VI), copper(II), and chloride interfere, and no gold(III) can be tolerated.

The mole ratio method, the continuous variations method, and the slope ratio method all show the mole ratio of DMABR to palladium to be 2:1.

Microfilm \$2.75; Xerox \$4.60. 87 pages.

CHEMISTRY, ANALYTICAL

**THE ANALYTICAL CHEMISTRY
OF THE PYRIDINE THIOCYANATES
OF DIVALENT CATIONS**

(L. C. Card No. Mic 60-6645)

Stephen Sydney Baird, Ph.D.
The University of Texas, 1958

Supervisor: Gilbert H. Ayres

The pyridine thiocyanates were prepared of copper(II), nickel(II), cobalt(II), iron(II), manganese(II), zinc(II) and cadmium(II). The properties of copper pyridine thiocyanate were studied in some detail. The properties of nickel(II), cobalt(II), iron(II) and manganese(II) pyridine thiocyanates were studied in somewhat less detail.

Methods for detection and determination of copper, nickel, cobalt, iron and manganese were developed based upon the chloroform extraction of the pyridine thiocyanates. The visible and infrared spectra of the compounds were recorded. A number of different avenues for additional research on the study and applications of the pyridine thiocyanates were suggested. Infrared and titrimetric methods for the determination of pyridine were developed.

Microfilm \$2.75; Xerox \$6.80. 145 pages.

**CHARACTERISTICS OF VOLTAMMETRIC
ION EXCHANGE MEMBRANE ELECTRODES.
DIFFUSION PROCESSES IN
ION EXCHANGE MEMBRANES.**

(L. C. Card No. Mic 60-6568)

Royce W. Murray, Ph.D.
Northwestern University, 1960

Supervisor: Richard C. Bowers

In recent years R. C. Bowers and A. M. Wilson derived the theoretical current-time relations for linear finite diffusion and confirmed these relations with an electrode using cellophane membranes as the diffusion layer. Deviations from theory were noted for certain ions and were attributed to adsorption processes within the cellophane. This author has studied the adsorption properties of this cellophane toward cadmium and hydrogen ions using the voltammetric membrane electrode. It has been shown that the adsorption is an ion exchange phenomenon arising from the presence of weak acid functional groups in the cellophane structure. The concentration and pKa of these groups have been measured.

A different type of cellophane has been prepared and, by study of the adsorption properties toward hydrogen ion, it has been demonstrated that this cellophane is chemically "cleaner" than that used by Bowers and Wilson. A synthetic carbmethoxycellulose ion exchange membrane has been prepared from the new type of cellophane. Using this ion exchange membrane, the characteristics of a voltammetric ion exchange membrane electrode (V.I.E.M.E.) were studied in more detail than was possible using the

two low capacity cellophanes above. The partition of ions into the membrane diffusion layer gives the V.I.E.M.E. good concentration sensitivity. Film diffusion control has been observed at high partitions and equations have been derived which quantitatively account for the film effects. Using the V.I.E.M.E., insight into the nature of ion exchange diffusion processes has been gained. The data have confirmed the theory of Schögl that two basic mechanisms for diffusion can occur in ion exchange systems; a free diffusion and a site-to-site transport. The site-to-site transport mechanism was proposed to account for diffusion in the absence of diffusible co-ion in the system. The present work shows that this mechanism is also induced by association of the ion in question with the exchange groups. A site-to-site diffusion process then may occur even in the presence of appreciable concentrations of co-ion. The site-to-site process in this system has been visualized to be a dissociation-diffusion-association mechanism, with a rate-controlling dissociation step.

Microfilm \$2.75; Xerox \$5.20. 104 pages.

ANION EXCHANGE SEPARATIONS
OF METAL IONS IN
PARTIALLY NONAQUEOUS SOLUTIONS

(L. C. Card No. Mic 61-469)

Donald John Pietrzyk, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: James S. Fritz

Distribution coefficients of metal ions between Dowex 1 X8, chloride form resin and organic solvent-water mixtures containing hydrochloric acid are measured. The presence of an organic solvent causes metal ions to be taken up by the anion resin at lower hydrochloric acid concentrations. In many cases, distribution coefficients are significantly higher than in water-hydrochloric acid systems. Methyl alcohol, ethyl alcohol, isopropyl alcohol, acetone, and dioxane are the organic solvents.

Three approaches are used to alter the batch distribution coefficient. (1) The hydrochloric acid concentration is increased while holding the concentration of the organic solvent constant. (2) The concentration of the organic solvent is increased while holding the hydrochloric acid concentration constant. (3) The organic solvent is changed or mixed with another organic solvent while holding the water and hydrochloric acid concentration constant.

The data are used for the prediction of eluting agents for separations of metal ion mixtures. Successful separations by elution with alcohol-water-hydrochloric acid mixtures of different compositions are reported.

Microfilm \$2.75; Xerox \$5.80. 119 pages.

ELECTROCHEMICAL STUDIES OF SALTS
IN ANHYDROUS ETHYLENEDIAMINE

(L. C. Card No. Mic 60-6326)

Joseph Roy Siefker, Ph.D.

Indiana University, 1960

Electrochemical studies of ionic solutes were carried out in the non-aqueous solvent ethylenediamine. The studies were made to delineate the role the solvent plays in determining the direction and extent of equilibrium reactions involving solute ions. The behaviors of inorganic salts in ethylenediamine may be expected to differ from those observed in aqueous solutions because of the low dielectric constant of ethylenediamine (12.4) and its ability to form strong coordinate bonds (chelates) with transition metals and certain heavy metal ions.

Polarographic half-wave potentials and potentials of a silver wire or a mercury pool indicator electrode were measured under practical (low-resistance, high salt concentration) electrochemical conditions. The potentiometric measurements were also made under conditions better suited for precise physical-chemical studies. All potentials were measured versus a zinc amalgam-zinc chloride reference electrode in ethylenediamine.

Half-wave potentials of thallium, cadmium, copper, zinc, and oxygen were obtained in ethylenediamine containing 0.25 molar lithium chloride or 0.25 molar sodium nitrate as supporting electrolyte. The half-wave potentials of thallium and cadmium were also studied as a function of supporting electrolyte concentration. At higher concentrations of sodium nitrate, the half-wave potentials of both cations showed shifts of approximately thirty millivolts for a ten-fold change in supporting electrolyte concentration. These results are in accord with those predicted for the case of predominant ion-pair formation involving both the reducible cation and the supporting electrolyte salt.

From analysis of polarographic half-wave potential data for solutions containing varying concentrations of complexing ligand, an apparent formation constant of 62 was determined for the complex of cadmium with hydroxy-ethylethylenediaminetriacetic acid in ethylenediamine. From silver wire potential measurements of solutions containing varying concentrations of sodium cyanide and a constant analytical concentration of silver ion, the stepwise formation constants of the silver-cyanide complexes were determined in solutions with and without 1 molar sodium nitrate present. The apparent constants obtained in the solution containing 1 molar sodium nitrate are $K_1 = 4 \times 10^6$ and $K_2 = 7.6 \times 10^{11}$, whereas the constants obtained in the other solution are $K_1 = 5 \times 10^7$ and $K_2 = 2 \times 10^{13}$. The differences in the apparent constants result from neglecting the effect of ion-pair formation in ethylenediamine. Using potential data given by a mercury pool indicator electrode, the method of Leden and of DeFord and Hume was used to calculate the apparent formation constants for the mercuric-iodide complexes in ethylenediamine. The constants are $K_1 = 24$ and $K_2 = 112$.

The ion-pair formation constants of a series of silver salts were obtained in ethylenediamine solutions containing silver nitrate, chloride, bromide, or iodide. In addition, the constants were measured in solutions containing a silver salt and a second salt having an anion in common

with the silver salt. Further, the ion-pair formation constant of silver iodide was determined in solutions containing sodium nitrate and sodium iodide in addition to the silver salt. When more than one salt was present, the data were corrected for ion-pairing of the non-silver salt. When only the silver salt was present, the data were corrected for activity coefficients also and gave the following values: $K_{AgNO_3} = 2.2 \times 10^3$, $K_{AgCl} = 3.3 \times 10^3$, $K_{AgBr} = 1.3 \times 10^4$, and $K_{AgI} = 6.7 \times 10^4$.

The average standard potential of silver in ethylenediamine versus the zinc amalgam-zinc chloride reference electrode was calculated from the above data to be 1.534 volts with a standard deviation of ± 0.010 volts. The values included in the average were all corrected for ion-pair formation and, in some cases, for activity coefficients. The activity coefficient corrections were not large because of extensive ion-pair formation.

Microfilm \$2.75; Xerox \$6.80. 145 pages.

SPECTROPHOTOMETRIC DETERMINATION OF RHENIUM WITH 4-METHYL-1,2-CYCLOHEXANEDIONEDIOXIME (4-METHYLNIOXIME).

(L. C. Card No. Mic 61-238)

Shih-Fan Ting, Ph.D.
University of Alabama, 1960

A simple and rapid procedure for the spectrophotometric determination of rhenium has been developed.

The method is based upon the formation of a soluble, stable, yellow-green rhenium-4-methylnioxime chelate, where rhenium(VII) is reduced by tin(II) chloride in a dilute hydrochloric acid solution in the presence of 4-methylnioxime.

The color develops in less than 5 minutes and the chloroform extract shows maximum absorption at 436 m μ . Calibration curves for both single and triple extractions, prepared by plotting micrograms of rhenium versus absorbance at 436 m μ for 5 or more samples ranging from 20 to 160 μ g. of rhenium in 50 ml. of solution, conform to Beer's law. The absorbancy of the chloroform extract of the chelate and the blank remains almost constant for 24 hours or more when room temperature is about 25°C and the complex is formed and extracted under optimum conditions.

The distribution ratio of the complex between chloroform and water is about 85. Thus, it is necessary to extract with three 4, 3 and 3 ml. portions of chloroform for quantitative extraction of the complex. However, good results can be obtained by extracting with one 10-ml. portion of chloroform provided the same technique is used to prepare the calibration curve. The molar extinction coefficient for rhenium-4-methylnioxime is about 68,900 (triple extraction) as compared to less than 45,000 reported for other methods for rhenium.

Neither the aqueous solution nor the chloroform extract of 4-methylnioxime absorbs throughout the entire visible region. The chloroform extract of tin-4-methylnioxime shows some absorption at 436 m μ , however, this interference is cancelled in the determination of rhenium because the blank contains all the reagents except rhenium.

The hydrochloric acid concentration at which the complex is formed is rather critical. The maximum color intensity is developed with a hydrochloric acid concentration of 0.43 ± 0.05 N. The absorbancy decreases and the rate of fading increases somewhat for higher and lower concentrations of acid. The optimum tin(II) chloride concentration for maximum development and stability of color was found to be 0.25%. A 20% increase or decrease in the concentration of tin(II) chloride only produced 1 to 1.5% deviation in absorbancy. The concentration of hydrochloric acid and tin(II) chloride is readily obtained by adding the desired amount of these reagents to the tin(II) chloride solution and measuring the reagent with a pipet.

Eighty-five milligrams of 4-methylnioxime are capable of converting 160 μ g of rhenium in 50 ml. of solution quantitatively to the rhenium-4-methylnioxime complex. Less than 1% deviation in the absorbancy is produced by varying the concentration of the 4-methylnioxime by $\pm 20\%$ from the optimum--85 mg. per 50 ml. of solution.

This method is applicable to the spectrophotometric determination of less than 0.001% to more than 1.0% rhenium in molybdenite concentrate and "molybdenite roaster flue dust." Interfering elements--molybdenum, iron, copper, selenium, nickel, gold, and silica--commonly found in these materials are removed in three operations; namely, evaporation with hydrochloric acid, precipitation of hydrous oxide with ammonia-water, and formation of metal-organic compounds with ethyl xanthate and chloroform extraction from a dilute hydrochloric acid solution. Bromine oxidation was employed before the ethyl xanthate extraction to ensure that the molybdenum is in its highest oxidation state.

Care should be taken during solution of sample by dilute nitric acid and subsequent hydrochloric acid evaporations to keep the solution below boiling temperature to avoid losing rhenium by volatilization.

Microfilm \$2.75; Xerox \$6.20. 128 pages.

EMISSION SPECTROCHEMICAL DETERMINATION OF RESIDUAL TRACE ELEMENTS IN SPONGE COPPER POWDERS

(L. C. Card No. Mic 60-6685)

Anna Margaret Yoakum, Ph.D.
The University of Florida, 1960

A new quantitative method for the emission spectrochemical determination of residual trace impurities in sponge copper powders has been proposed. The method is rapid, accurate and requires a minimum amount of sample preparation.

The lack of available powder standards made it necessary to use a method which was self-sufficient spectrographically to validate the composition of the five powders which were to serve as standards in the powder method. A solution technique utilizing the standard addition method of analysis was used for this purpose.

The powder method consisted of weighing the powder directly into the cavity of a preformed graphite electrode and analyzing it with Uni-arc excitation. The copper matrix of the samples afforded many inherent advantages and provided an excellent source of internal standard lines.

Eight residual trace impurities--chromium, iron, lead, manganese, nickel, tin, silver, and zinc--were determined in several copper powders. The accuracy and precision of the method was limited primarily by the inherent error of about 3% associated with the photographic techniques employed. Microfilm \$2.75; Xerox \$4.00. 75 pages.

CHEMISTRY, BIOLOGICAL

SOME EFFECTS OF
2,4-DICHLOROPHENOXYACETIC ACID ON
THE CARBOHYDRATE METABOLISM
OF ETIOLATED CORN SEEDLINGS.

(L. C. Card No. Mic 60-6660)

Clanton C. Black, Jr., Ph.D.
The University of Florida, 1960

The plant growth-regulator 2,4-dichlorophenoxyacetic acid (2,4-D) was introduced in the early nineteen-forties. Copious amounts of research have been directed at attempting to elucidate the basic mechanism of mechanisms whereby 2,4-D influences plant growth. Despite the intensive and persistent efforts of research workers to solve this problem, the basic mode or modes of action of 2,4-D are not known.

Recently, it was reported that 2,4-D affected the *in vivo* catabolism of glucose in etiolated corn seedlings (*Zea mays* L.) by increasing the participation of the pentose phosphate pathway. A series of experiments were conducted to study the effects of 2,4-D on the *in vitro* activity of enzymes extracted from etiolated corn roots in an attempt to determine the mechanism whereby 2,4-D shifted the normal pathway of glucose catabolism. Comparisons were made between the activities of enzymes extracted from the roots of both buffer and 2,4-D treated etiolated corn seedlings.

Three-day-old etiolated corn seedlings were divided into two groups and treated either with 10^{-2} molar phosphate buffer (pH 5.3) or with buffer plus 10^{-3} molar 2,4-D for 12 hours at 22° C. After the 12 hour treatment period, the seedlings were removed, washed, blotted dry and the roots excised. The roots were weighed and used to prepare enzyme extracts. Cell-free extracts and acetone powder extracts were prepared from each group of seedlings. The activities of the enzymes of both the glycolytic and the pentose phosphate pathway were studied employing either cell-free extracts or acetone powder extracts as the enzyme source. Individual enzymes were studied in reaction mixtures containing excess substrate plus the known cofactors, with enzyme concentration being the limiting factor of the reaction. The activity of each enzyme was determined in extracts from both buffer and 2,4-D treated tissues.

The *in vitro* studies demonstrated that treatment of corn seedlings with 2,4-D prior to preparing the enzyme extracts results in a general enhancement of the activity of the pentose phosphate pathway. This enhancement is evidenced in an increased utilization of ribose-5-phosphate, an increased formation of heptulose and hexose

from ribose-5-phosphate, and an increased rate of oxidation of both glucose-6-phosphate and 6-phosphogluconate in enzyme extracts from 2,4-D treated tissue.

The *in vitro* studies of the enzymes of the glycolytic pathway indicated that 2,4-D treatment of corn seedlings decreases the activity of 6-phosphofructokinase, aldolase and glyceraldehyde-3-phosphate dehydrogenase. The activity of pyruvic kinase, although not quantitatively measured, also was slightly decreased following 2,4-D treatment. The activities of phosphoglucoisomerase, phosphoglyceric kinase and enolase were not affected by 2,4-D treatment. Studies of phosphoglyceric mutase were inconclusive.

The results of these *in vitro* studies support the *in vivo* observation that 2,4-D treatment of etiolated corn seedlings affected glucose catabolism through an increase in the amount of glucose catabolized via the pentose phosphate pathway. Since the enzymes of both pathways were present in extracts from 2,4-D treated tissue, a theory is presented and discussed which proposes that 2,4-D in some manner affects the normal metabolic control mechanisms of intact cells.

Microfilm \$2.75; Xerox \$5.40. 106 pages.

RUMINAL NITROGEN METABOLISM,
IN VITRO AND IN VIVO.

(L. C. Card No. Mic 60-6779)

Richard Allen Bloomfield, Ph.D.
University of Missouri, 1960

Supervisor: Dr. Merle E. Muhrer

This investigation was designed to study nonprotein nitrogen metabolism in ruminants and encompassed the following objectives:

1. To investigate the cause of the low biological value of nonprotein nitrogen (NPN) in ruminants.
2. To study some of the factors which effect the conversion of NPN to bacterial protein.
3. To determine the fate of NPN absorbed by the ruminant animal.

A method was utilized in which rumen contents were removed at intervals and serial samples taken from these aliquots after incubation. This allowed the rate of nitrogen metabolism *in vivo* to be studied. Urea hydrolysis occurred at the rate of 80 mg nitrogen per 100 ml rumen fluid per hour. Ammonia uptake proceeded at the rate of 20 mg nitrogen per 100 ml rumen fluid per hour. This excessive ammonia appeared in the portal blood. These quantitative data support the hypothesis that urea hydrolysis occurs more rapidly than uptake of the ammonia. Rumen microorganisms took up an average of 30.54 ± 9.2 per cent of the ammonia present per hour.

Of the amino acids found free in the rumen, proline and possibly lysine gave an increased growth of bacteria in the presence of urea *in vitro*. A quantitative amino acid analysis was made of rumen microorganisms from a sheep fed urea compromising 99 per cent of the ration nitrogen. This analysis showed that all the essential amino acids

were present (tryptophan not determined) in relative proportions that should satisfy the requirements of the host animal.

An *in vitro* system showed that urea could pass from the serosal to the mucosal side of the rumen wall. This mechanism proceeded at the rate of about 0.036 mg urea nitrogen per hour per cm². This system was inhibited by 10⁻⁵ M cyanide. Passage in the opposite direction was insignificant.

One of several different *in vitro* rumen epithelial tissue incubations showed amide synthesis from ammonia. This could not be shown *in vivo* when a small section of the rumen was tied off to form a pouch. Ammonia was injected into this pouch and the blood of the rumen vein draining this area was analyzed. Only an increase in ammonia and not amide could be found in the blood.

Butyric acid appeared to inhibit urea synthesis by bovine liver slices while taking up ammonia. Succinic acid increased urea synthesis. An amide synthesizing enzyme was demonstrated in acetone powders of bovine liver.

Amide nitrogen appears to be the immediate fate of absorbed ammonia in the ruminant. In one trial, toxic symptoms from a large dose of urea did not appear until the amide nitrogen had reached its highest level. Arginine exerted a protective effect on high peripheral blood ammonia levels. When arginine was injected into the portal vein, jugular vein ammonia levels decreased.

An inverse correlation seemed to exist between blood amide nitrogen and urea nitrogen in both ruminants and non-ruminants.

It can be concluded that:

1. *In vivo* urea hydrolysis proceeded at a rate 4 times faster than the ammonia uptake by the rumen microorganisms. This excess ammonia was absorbed into the portal vein and converted to amide nitrogen in the liver.
2. Rumen microorganisms take up a fixed percentage of the ammonia present in a given time. This value averaged 30.54 ± 9.2 per cent per hour.
3. Passage of urea across the rumen wall was only in the direction of serosal to mucosal side. This can be inhibited by cyanide.
4. The immediate fate of absorbed ammonia nitrogen was synthesis to amide by the liver.
5. Arginine appears to protect the animal against high blood ammonia levels.

Microfilm \$2.75; Xerox \$5.60. 113 pages.

STUDIES OF RAT LIVER MALIC DEHYDROGENASE

(L. C. Card No. Mic 61-89)

Alvin Clifford Boyer, Ph.D.
University of Illinois, 1960

1. Graphical interpretation of kinetic data permitted the determination of a possible mechanism of MDH catalysis and the calculation of the dissociation constants of

enzymatic DPNH and DPN binding. At pH 9.0, K_{DPNH} was found to be 4 x 10⁻⁵ M. and K_{DPN} 4 x 10⁻⁴ M. The most likely of the mechanisms tested for MDH catalysis is that developed by Theorell and Chance for alcohol dehydrogenase.

2. The substrate inhibition of OAA was shown to be a function of concentration and pH. At pH 6.0 the inhibition can be reversed by increasing the concentration of DPNH.

3. Data from the enol-ketone equilibrium of hydroxy-maleic acid and the non-enzymatic decomposition of OAA were shown to be of little consequence in the kinetic studies undertaken at pH 9.0.

4. The pH optimum for MDH catalysis from the malate side of the reaction was determined to be between pH 9.0 and 9.4.

5. The pH-independent equilibrium constant was demonstrated to be 8.27 x 10⁻¹³ when determined at pH 8.96 only.

6. The fluorescent characteristics of the rat liver MDH-DPNH complex were determined.

7. The fluorescent characteristics were used to determine the stoichiometry and dissociation constant of the enzymatic DPNH binding. One mole of DPNH is bound per mole of enzyme. K_{DPNH} was found to be 1 x 10⁻⁷ M. at pH 9.0.

8. The presence of malate was found to have a definite effect on DPNH binding as shown spectrophotofluorometrically.

9. Three sets of conditions for kinetic instability of MDH were determined for use in protection studies.

10. Protection studies indicate that DPN⁺, DPNH and OAA exhibit a protective action toward the enzyme in an environment in which the enzyme would otherwise be inactivated.

11. The amount of protection of MDH is a function of the concentration of the protective agent.

12. The order of protection which various component parts of the DPN⁺ molecule exhibit toward the enzyme are DPN⁺ = ADP > AMP > adenosine > adenine > purine > nicotinamide > nicotinic acid.

13. Kinetic inactivation of MDH due to urea is both instantaneous and partially reversible.

14. The energy of activation for the inactivation of MDH was determined in the presence and absence of 1 x 10⁻³ M. DPNH. The values are 75 kcal/mole and 65 kcal/mole respectively. Microfilm \$2.75; Xerox \$6.00. 125 pages.

MECHANISM OF RIBOFLAVIN-CATALYZED OXIDATIONS

(L. C. Card No. Mic 61-440)

Daniel Oscar Carr, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: David E. Metzler

Flavoenzymes are known to catalyze many oxidation-reduction reactions. Non-enzymic experiments have been reported for only a few of these reactions and these experiments were models for the respiratory chain reactions. Attempts to conduct single product, non-enzymic oxidation-reduction reactions at the substrate level are now reported.

Amino acids, amines, glucose, dihydroorotic acid, and reduced α -lipoic acid do not undergo unambiguous oxidation-reduction reactions with riboflavin.

Ethyl Δ^3 -dihydro- β -naphthoate is a substrate for a flavin catalyzed oxidation. The product is exclusively β -naphthoate. The reaction has a heat of activation of + 14.6 kcal mole⁻¹ when conducted in the dark. The second order rate constant is 25 l mole⁻¹ min⁻¹ at 95°. The reaction is light catalyzed. When a 15 watt fluorescent tube is used to catalyze the reaction, in a 1 cm silica cuvette, at a distance of 12 inches, the second order rate constant at 25° is 5.38×10^2 l mole⁻¹ min⁻¹. The heat of activation of the photooxidation is -2.25 kcal mole⁻¹.

The photoreaction has been characterized as to the influence of pH, solvent, ionic strength, inorganic ions, and nature of the flavin.

The isomeric esters, as well as the dihydro- β -naphthoic acids, do not give the unique photooxidation to β -naphthoate. Also, hydrocinnamate, a monocyclic analog, does not oxidize. Nicotinamide-1-propochloride does not oxidize ethyl Δ^3 -dihydro- β -naphthoate. The scheme of oxidation is proposed.

Leucoflavin (dihydroriboflavin) was prepared by catalytic hydrogenation and was characterized as to pK, spectra of all forms, and reactivity with oxygen, riboflavin, and other reducible compounds. Leucoflavin has pK values of 6.1 and less than 2. The molar absorptivity indexes for the forms about the pK of 6.1 are: basic form, $a_{M250} = 2.81 \times 10^4$ and $a_{M260} = 3.12 \times 10^4$; acid form $a_{M250} = 2.36 \times 10^4$ and $a_{M300} = 8.03 \times 10^3$. There is an isosbestic point at 300 m μ , $a_M = 8.03 \times 10^3$.

A semiquinone species (pH < 1) is obtained on mixing equimolar amounts (2×10^{-5} M) of leucoflavin and riboflavin. Also, riboflavin solutions which are photoreduced to one-half the initial riboflavin concentration exhibit a semiquinone spectrum at pH < 1.

The physical properties of riboflavin, viz., solubility, heat stability, and light stability, have been further investigated.

The anaerobic photoreduction of riboflavin apparently occurs by the oxidation of the riboflavin polyhydric side chain. This conclusion is evidenced by the fact that lumiflavin (no hydroxy side chain) does not photoreduce in aqueous solution but does so in solutions containing ethanol or glycerol.

Polarography was used in an attempt to detect any metalflavin interaction or any flavin molecular complexes.

Microfilm \$2.75; Xerox \$7.60. 163 pages.

SOIL MICROORGANISMS AND PTERIDINE METABOLISM

(L. C. Card No. Mic 60-6609)

Irene Anne Mydlinski Cotton, Ph.D.
The University of Texas, 1960

Supervisor: Dr. Wilson Stewart Stone

Microorganisms, isolated from soil by the enrichment culture technique, were found to utilize the following pteridines: 2-amino-4-hydroxypteridine (I), 2-amino-4-hydroxypteridine-6-carboxylic acid (II), and 2-amino-4,6-

dihydroxypteridine (III). I was converted to rhizopterine, II was converted to a compound whose tentative formula is 2-amino-4-hydroxypteridine-6-carboxythiol and III was converted to 2,4,6-trihydroxypteridine. The conversion of 2-amino-4,6-dihydroxypteridine (xanthopterin) to 2,4,6-trihydroxypteridine was studied using a purified enzyme preparation from the bacteria. The enzyme, xanthopterin deaminase, appears to be specific for xanthopterin. The reaction is not reversible under the conditions of the experiment. The significance of these findings with regard to the biological role of the pteridines in general is discussed. Microfilm \$2.75; Xerox \$4.40. 85 pages.

IN VITRO CONVERSION OF CAROTENE TO VITAMIN A

(L. C. Card No. Mic 61-444)

Richard Earl Dugan, Ph.D.
Iowa State University of Science and Technology, 1960

Supervisor: Dr. R. S. Allen

Experiments were performed on the *in vitro* conversion of β -carotene to vitamin A by excised vitamin A deficient rat small intestine and homogenates thereof. In conjunction with these experiments methods of purification and estimation of microgram quantities of vitamin A were investigated.

Several methods of vitamin A analysis were tested and found to be unsatisfactory because of certain features of the intestinal milieu. The destructive irradiation method of analysis was found to be unreliable because of a light sensitive material present in vitamin A deficient rat intestine. A paper chromatographic procedure that separated vitamin A from β -carotene without loss due to decomposition was developed. However, this method had limited application because the efficiency of the separation was considerably reduced in the presence of considerable amounts of lipid material.

A method of analysis was developed that met the problems imposed by *in vitro* conversion studies of carotene to vitamin A and gave reliable estimations of vitamin A at the microgram level. By this method vitamin A was separated from β -carotene and most carotene degradation products in the non-saponifiable extract by partition chromatography on a silica gel column containing adsorbed methanol. On the purified vitamin A fraction it was necessary to measure the absorption spectrum and perform the Carr-Price color test as well in order to achieve a clear-cut quantitative estimation.

Using this method of analysis low level *in vitro* vitamin A formation (0.8 μ g per intestine) was detected in excised whole intestine under the following conditions: β -carotene and γ -tocopherol were solubilized in soybean oil and the oil solution was dispersed in 10% Tween 80 in glucose-containing Ringer-Locke solution. The resultant mixture was incubated in excised vitamin A deficient rat small intestine for one hour at 39°C under an oxygen atmosphere.

In other experiments a number of additives were presented with β -carotene in an attempt to promote vitamin A formation in excised whole intestine and tissue

homogenates. Among those tested were various Tweens, bile salts, and a water-dispersible gelatin preparation of beta-carotene, alpha- and gamma-tocopherols, albumen, hydrogen peroxide, and glucose. Incubation baths were usually composed of Ringer-Locke solution. Homogenates were incubated in phosphate buffers as well as Ringer-Locke solution. Incubation times and temperatures were varied and atmospheres of nitrogen, air, and oxygen were tested. Under no set of conditions, except those specified above, was vitamin A formation detected.

A study on the dispersion of carotene in Tween as a function of Tween concentration showed that degree of dispersion of carotene increased, but not linearly, with Tween concentration. A Tween concentration range was located in which change in degree of dispersion of carotene was minimal.

Microfilm \$2.75; Xerox \$6.20. 129 pages.

COMPARATIVE CHEMICAL AND BIOLOGICAL STUDIES ON THE FRACTIONATION OF DEOXYRIBONUCLEIC ACIDS

(L. C. Card No. Mic 60-6668)

Fred Robert Frankel, Ph.D.
The University of Florida, 1960

Studies concerned with structural and biological properties of deoxyribonucleate are hindered because specimens of this material from individual sources consist of populations of closely related but chemically distinct molecules. The present investigation has been concerned with the development of methods which allow the fractionation of specimens of deoxyribonucleate into arbitrary groups which are more homogeneous than the original starting material.

The fractionation technique used in these studies stems from the finding that calf thymus deoxyribonucleate, despite its polyanionic character, is bound by columns of the magnesium form of Amberlite IRC-50 (Mg IRC-50), a polycarboxylic acid resin. Elution of the nucleate by means of $\text{Mg}(\text{OAc})_2$ solutions of increasing concentration yields successive fractions of gradually changing composition. The fractions which are eluted early, and therefore have the least affinity for the ion exchange resin, are relatively enriched with respect to their content of guanine and cytosine, while those fractions with greatest affinity for the resin contain a relative abundance of the other two bases found in deoxyribonucleate, adenine and thymine. An effective fractionation of the nucleate molecules has also been achieved by deliberately exceeding the capacity of the columns so that some material is of necessity eluted immediately. The material remaining adsorbed to the resin is then recovered by gradient elution as before. The molecules of deoxyribonucleate which are excluded under these conditions are again rich in guanine and cytosine. Moreover, 5-methylcytosine, a base which is present in very low amounts in specimens of deoxyribonucleate from mammalian sources, has been found to be distributed among the fractions non-randomly. Rechromatography has shown that the position of elution of the different molecules is an intrinsic property of the molecules.

Certain factors have been shown to influence strongly

the interaction of these two polyanions. In contrast to the strong binding which occurs in solutions of 0.05 M $\text{Mg}(\text{OAc})_2$ of pH 7 to 8, deoxyribonucleate exhibits no affinity for a column of Mg IRC-50 which has been equilibrated with 0.05 M $\text{Mg}(\text{OAc})_2$ of pH 6. The assignment of a particular group responsible for this pH effect is difficult since both the carboxyl groups of the resin and the secondary phosphate groups of the deoxyribonucleate titrate in this pH region. When the effect of temperature was examined, it was found that elution of the nucleate at 50° C resulted in a significant retardation compared to the results obtained at 30° C. This greater affinity of the resin may result from an increase in the number of available binding sites at the higher temperature. Increased interaction may also be enhanced by a decrease in the degree of hydration of the two polymers. Divalent cations other than Mg^{++} are able to mediate the binding of deoxyribonucleate to IRC-50, and NaOAc was found to be more effective than $\text{Mg}(\text{OAc})_2$ in its eluting ability. While elution may be essentially ionic strength dependent, there may also exist specific cation binding effects.

The ability of Mg IRC-50 to separate chemically different molecules of deoxyribonucleate suggested that information regarding the biosynthesis of these molecules might be provided by studies of the initial rates of incorporation of radioactive precursors into chromatographically different fractions of the nucleate. In these studies, mice containing five day old cultures of Ehrlich ascites tumor cells were injected with 5 μ curies of C^{14} -formate and sacrificed after five minutes. Deoxyribonucleate was isolated from the ascites cells and chromatographed under overload conditions on Mg IRC-50. The extreme fractions differed less in base content than did corresponding fractions from specimens of deoxyribonucleate from calf thymus. The specific radioactivity of thymine in these fractions was determined. While the portion of the nucleate which was excluded from the columns had a specific activity like the total material, the fractions recovered by gradient elution had an activity of about one-half this amount. Of particular interest was material which could be eluted by raising the temperature of the column from 30° to 45° C and changing the eluent to 1 M $\text{Mg}(\text{OAc})_2$. This material has an activity three to five times greater than that of the total preparation. Base analysis showed that it had a composition like the total material. Experiments with H^3 -thymidine yielded a similar distribution of specific activities. Several hypotheses were proposed to explain the differential incorporation of radioactivity.

Microfilm \$2.75; Xerox \$5.20. 101 pages.

SOME PHYSICAL CHEMICAL PROPERTIES OF MICROSOMAL RIBONUCLEOPROTEIN FROM RAT LIVER

(L. C. Card No. Mic 60-6472)

Mary Jane Gill Hamilton, Ph.D.
Cornell University Medical College, 1961

Chairman: Associate Professor Mary L. Petermann

Rat liver microsomal ribonucleoprotein (RNP) of high molecular weight, the postulated template material of

cytoplasmic protein synthesis, was isolated from the other cellular constituents by differential ultracentrifugation after release from the microsomal membranes by 0.5% sodium deoxycholate, and purified by a final precipitation with 0.005 M barium acetate or 0.01 M magnesium chloride. The purified RNP consisted of 45% ribonucleic acid and 55% protein. It had an anhydrous density of 1.53 g./ml. and a specific refractive index increment of 0.00202 for a 1% solution. Electrophoretically RNP migrated as a single asymmetric peak whereas ultracentrifugally it presented a complicated pattern with as many as seven sharp peaks. Ultracentrifugal analysis was used to study structural changes that occurred with changes in the ionic composition of the solution. The principal component, 83S, formed association products of 110S and 140S. A decrease in pH or an increase in magnesium concentration was followed by increases in the amounts of the 110S and 140S components, aggregation into polydisperse material of high sedimentation rates, and finally precipitation (at pH 5 or 0.01 M MgCl_2). Upon the removal of magnesium, the 83S component dissociated into nucleoprotein subunits of 46S and 30S; at pH 8, there was half as much 30S as 46S, whereas at lower pHs, 6 to 7, the 30S component was absent. Intermediate forms, 63S and 50S, were observed in the course of the dissociation. RNP was more stable in the presence of potassium than sodium salts. When the common divalent ions were compared, magnesium was much better than calcium, strontium, or barium in the preservation of the 83S component.

Magnesium binding was investigated by the equilibrium dialysis technique. More magnesium was bound at pH 6.5 than at pH 8.5. At 0.1 ionic strength the binding was weaker than at low ionic strength. Neither the maximum number of binding sites nor the first association constant could be evaluated from the Scatchard plot of r/M against M because of its pronounced curvature. It was clear that much nonspecific binding of magnesium could occur. Although it seemed probable that specific site binding was also involved, it was impossible to distinguish such sites by the technique used. Some of the samples were examined by moving boundary electrophoresis. The mobilities decreased with increased amounts of bound magnesium. The mobilities at pH 8.5 were higher than at pH 6.5, and also showed a greater dependence on the amount of bound magnesium. The samples binding the most magnesium gave the most symmetrical patterns.

The chief difficulties in measuring the physical chemical properties of RNP arose in obtaining the 83S component free of other components, especially the larger polydisperse aggregates. In sedimentation studies the fast, polydisperse material was considered to have had no effect on the sedimentation rate of the 83S component. The sedimentation coefficient was strongly dependent on the concentration as described by the equation, $s_0/s = 1 + 0.285c$, where $s_0 = 83.0$ S and c is the concentration in g./dl. The viscosity of RNP showed no shear dependence. The intrinsic viscosity was 0.12 per gram per deciliter. Since the solutions were not monodisperse, this value may not represent the intrinsic viscosity of pure 83S RNP. Zone centrifugation into a sucrose gradient was used to obtain monodisperse solutions of the 83S component for characterization by light scattering. The molecular weight of the 83S component was found to be 3.6 million with an estimated uncertainty of about 10%.

Thus, the chief component of rat liver RNP is a highly

hydrated macromolecule with a sedimentation coefficient of 83S and a molecular weight of about 4 million made up of nucleoprotein subunits held together chiefly by magnesium ions.

Microfilm \$2.75; Xerox \$8.60. 186 pages.

CHANGES IN BLOOD PROTEINS DURING ANURAN METAMORPHOSIS

(L. C. Card No. Mic 60-3310)

Albert E. Herner, Ph.D.
The Florida State University, 1960

Associated with anuran metamorphosis is a change in the electrophoretic character of the serum protein and the hemoglobins as well as an increase in both total serum protein and hemoglobin concentrations. The electrophoresis experiments were on paper using veronal buffer at pH 8.6. The most striking change in the serum proteins is the marked increase in and eventual predominance of the albumin fraction. In the *Ranidae*, metamorphosis results in a redistribution of the globulins in favor of the electrophoretically slowest- and fastest-moving components. The slower-moving globulins predominate throughout the development of *Xenopus laevis*. The electrophoretic patterns of the young *Ranidae* tadpoles (particularly *R. heckscheri*) are similar to those of adult salamanders whereas patterns prepared from *Ranidae* frog sera resemble those of the lizards. Though the albumin fraction of all the *X. laevis* animals has a greater mobility than this fraction in either the *Ranidae* or human serum, the *Xenopus* frog patterns are more similar to human serum patterns than are the *Ranidae* frog patterns. Differentiation of the *Ranidae* serum protein patterns ceases with the completion of metamorphosis. However, for the *Xenopus* frog the total protein concentration and the albumin-to-globulin ratio continue to increase as the frog grows. The above findings are for spontaneous metamorphosis in all of the species studied and also for triiodothyronine-induced metamorphosis in the *Ranidae*.

As a result of metamorphosis, the electrophoretic nature of the anuran hemoglobins changes from components with a relatively high electrophoretic mobility in the tadpole to fractions with a lower mobility in the frog. During the metamorphosis of the species *R. grylio* the fastest-moving hemoglobin decreases both in extent of migration and in intensity. In addition to this fraction, a second, slower-moving hemoglobin appears in some of the animals bled 5 or 6 days after injection with triiodothyronine and in animals at the latter stages of spontaneous metamorphosis. The slower-moving hemoglobin becomes predominant and reaches a maximum intensity in the frog.

Protein fractions, in addition to the hemoglobin components, are made evident by bromophenol blue staining. These extra-hemoglobin fractions appear only in the hemoglobin solutions prepared from *Ranidae* tadpole red cells. One of these migrates to a similar position as that of the slow-moving hemoglobin found in the more advanced animals. It is suggested that this fraction might be a precursor of the slow-moving hemoglobin.

Fe^{59} uptake experiments, coupled with paper

electrophoresis, on *R. grylio* erythrocytes indicate that the red cells of the intermediate animals are most efficient in both iron uptake and hemoglobin synthesis. The red cells of the triiodothyronine-treated animals are least efficient in iron uptake. Young tadpole red cells appear to be the most poorly adapted for hemoglobin synthesis. Fe^{59} is taken up faster by frog red cells than by tadpole red cells. In no case does Fe^{59} appear in the non-hemoglobin fractions from the tadpole red cells.

In the species *R. grylio*, tadpole hemoglobin is more resistant to denaturation by alkali than is frog hemoglobin.

Associated with metamorphosis in the Ranidae are increases in both blood hemoglobin concentration and red cell count. There is also a concurrent change in the shape of the red cell to a more elliptical form.

Microfilm \$2.75; Xerox \$5.20. 101 pages.

IN VITRO LIPOLYSIS OF TRIGLYCERIDES BY BOVINE RUMEN MICROORGANISMS

(L. C. Card No. Mic 61-450)

Franklin Delano Hill, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: R. S. Allen

The lipase activity of bovine rumen liquid was demonstrated by in vitro studies of its action on triglycerides. Lipolysis of soybean oil and C^{14} -labelled tripalmitin during incubation with shaking at 38°C . was observed by assaying the fatty acids produced by extraction-weighing, extraction-titration and tracer techniques. A considerable range in enzymatic activity was found. Hydrolysis under carbon dioxide appeared to be linear the first 24 hours and subsequently plateaued. A short lag period (approximately 4 hours) occurred in trials performed without gassing. However, approximately the same degree of hydrolysis was observed in samples gassed with carbon dioxide and those not gassed. Gassing with nitrogen depressed activity considerably.

The level of enzyme activity varied greatly among different animals and in the same animal on different days. Samples of rumen liquid from animals on alfalfa pasture exhibited more lypolytic activity than did those from animals on dry feed and hay. Rumen liquid from animals more susceptible to bloat generally possessed higher levels of enzyme activity than did that from other animals; 10 ml. of the liquid hydrolyzed as much as 96% of a 0.5 g. sample in 24 hours. Antibiotics which decreased bloat severity of animals grazing alfalfa pasture also decreased the lipase activity of the rumen liquid. The activity varied diurnally in samples of ingesta obtained from fistulated animals on both dry feeds and alfalfa pasture. In each case high levels were observed prior to feeding both in the morning and mid-afternoon. Although hydrolysis of triglycerides occurred over a wide pH range, good correlation between enzymatic activity and high rumen pH values was observed. Maximal activity was obtained between pH values 6.8 and 7.4 in samples in which the pH was adjusted with phosphate buffer (0.1M).

The neutral fat remaining after various incubation periods was mainly triglyceride; relatively low levels of

mono- and diglycerides were found. No detectable degradation of the fatty acids formed by hydrolysis was noted.

Centrifugation studies indicated that the source of the lipase activity was not extracellular and was very easily centrifuged from the liquid. Limited observations of the activity in samples containing added mannose or antibiotics indicated that possibly three types of rumen microorganisms (holotrichs, oligotrichs and Gram-positive bacteria) are associated with the enzyme activity.

Microfilm \$2.75; Xerox \$5.40. 106 pages.

A STUDY OF THE EFFECTS OF AGE, SEX AND PYRIDOXINE-DEFICIENCY ON THE METABOLISM OF POLYUNSATURATED FATTY ACIDS IN THE RAT.

(L. C. Card No. Mic 60-6150)

John Charles Kirschman, Ph.D.
Vanderbilt University, 1960

Supervisor: Professor John G. Coniglio

Polyunsaturated fatty acid concentrations were determined in male and female Sprague-Dawley rats of weanling, three-months and six-months of age, and in three-month old pyridoxine-deficient and pair-fed non-deficient controls. The animals were maintained on a diet containing 25% casein and 20% Crisco. Assay of the polyenes was done by spectrophotometric analysis following alkaline isomerization of the total fatty acids in brain, heart, liver, kidney, lung, spleen, intestine, muscle, testes, and serum. The total fatty acids were extracted from the tissues following saponification with alcoholic KOH. A very low (less than 2%) diene concentration in brain was observed in the presence of relatively high tetraene concentrations (greater than 12%). The lowest polyene levels, in general, were the trienes (usually less than 2% of the total fatty acids). Tetraenoic acid concentrations were uniformly higher than those of most other tissue polyenes. With the exceptions of those tissues which were difficultly separated from depot fat (muscle and intestine) the concentration of tetraenes remained in constant ratio to the mass of tissue. It is suggested that the tetraenes serve some prime role common to several tissues of the rat. While some differences were observed between polyene concentrations of rat tissue with growth and maturation, the changes varied from tissue to tissue, were unique for each species of polyene, and often differed from one stage of development to another. The most marked single change with age was the sharp rise in pentaene concentration of testes between the ages of three weeks and three months. Since the pentaene levels of testes were much greater than in any other tissue, the observed rise with maturation indicates that they are related to the physiological function of testicular tissue. The hexaene concentrations of most tissues decreased with age. Brain contained higher levels of hexaenes than any other tissue and there occurred less variation with age in brain than in other tissues. Only in liver was there a significant difference in the polyene concentrations between male and female rats. Dienes and trienes were higher in livers of male rats while the livers of female rats

contained higher concentrations of tetraenes and hexaenes. None of the sex differences can be considered great enough to affect the choice of experimental animal for study of polyunsaturated fatty acid metabolism. Polyenes constituted a higher percentage of total fatty acids in the tissues of pyridoxine-deficient rats than in those of non-deficient pair-fed controls in animals fed 20% Crisco as well as in those animals whose dietary fat consisted of only 100 mg daily of linoleic acid as ester. Carcass tetraenes expressed as mg/gm of defatted carcass weight resulted in a ratio which was similar for both the pyridoxine-deficient and control animals. It is suggested, therefore, that rather than being directly dependent upon pyridoxine for its formation from linoleic acid arachidonic acid is related to pyridoxine only through the effect of this B-vitamin on the growth of the animal. Higher percentages of orally administered linoleic acid-1-C¹⁴ were absorbed by pyridoxine-deficient rats than by their pair-fed controls. The percentage of absorbed C¹⁴ expired as C¹⁴O₂ expressed per 100 grams of body weight was uniformly higher in deficient than in control rats, indicating that for linoleic acid pyridoxine deficiency increases the metabolic rate of rats. Smaller amounts of C¹⁴ were found in the arachidonic and linoleic acid fractions of livers from pyridoxine-deficient animals than in their controls.

Microfilm \$2.75; Xerox \$7.20. 153 pages.

STUDIES ON LIPOYL-X-HYDROLASE

(L. C. Card No. Mic 60-6649)

Mark Edward Levitch, Ph.D.
The University of Texas, 1959

Supervisor: Dr. L. J. Reed

An enzyme, designated lipoyl-X-hydrolase, has been obtained from cell-free extracts of *Streptococcus faecalis* (strain 10C1) which liberates free lipoic acid from the protein-bound form present in the *Escherichia coli* pyruvate dehydrogenation system, thereby inactivating the latter system. The released lipoic acid can then be separated from the enzymes by dialysis. Reactivation of the resulting apopyruvate dehydrogenation system required incubation of the preparation with lipoic acid and adenosine triphosphate (or synthetic lipoyl adenylate) and the lipoic acid-activating system from either *S. faecalis* or *E. coli*.

Lipoyl-X-hydrolase has been partially purified and some of its properties have been determined. Electrophoresis studies indicate that the enzyme is negatively-charged at pH 7.1. Centrifugation at 144,000xg for two hours failed to sediment the enzyme. The peptidase activity exhibited by the enzyme preparation as normally obtained, is not a characteristic of the lipoyl-X-hydrolase enzyme, and a separation of the two enzymatic activities has been demonstrated. In studies on substrate specificity using N-lipoyl amino acids, only one of the compounds tested (N-lipoylglycine) was hydrolyzed to a significant extent. Using enzyme preparations of different stages of purification, no correlation was found between lipoyl-X-hydrolase activity and the hydrolytic activity toward lipoylglycine.

An attempt has been made to determine the nature of

the moiety to which lipoic acid is attached in the *E. coli* pyruvate dehydrogenation system. Preliminary evidence indicates a possible linkage to an amino group of lysine.

Microfilm \$2.75; Xerox \$4.40. 82 pages.

AN ELECTROPHORETIC STUDY OF CALF THYMUS HISTONES

(L. C. Card No. Mic 60-6990)

Claude McClure, Jr., Ph.D.
The University of North Carolina, 1960

Supervisor: J. Logan Irvin

The purpose of the present study was to investigate by electrophoretic methods: (a) the parameters necessary for maximum resolution and separation into components of the unfractionated calf thymus histones; (b) the number of components and their relative electrophoretic mobilities in the two major fractions obtained by treatment of the whole protein with ethanol; and, (c) the possible interaction of the two fractions in a synthetic mixture. Studies also were designed to compare the results of moving-boundary electrophoresis of the individual histone fractions with analytical data obtained by ion-exchange chromatography of these fractions.

Thymus deoxyribonucleoprotein (DNP) was obtained from the frozen glandular tissue by the method of Mirsky and Pollister (*J. Gen. Physiol.*, 30, 117 (1946)) as modified by Petermann and Lamb (*J. Biol. Chem.*, 176, 685 (1948)). Unfractionated histones were prepared by extracting the DNP with 0.2 N hydrochloric acid, followed by dialysis and lyophilization.

Lysine- and arginine-rich histone fractions were prepared by ethanol fractionation of acid extracts of whole calf thymus gland, previously extracted with 0.14 M sodium chloride, in order to remove the ribonucleoprotein (RNP). The arginine-rich histone precipitated at a final ethanol concentration of 23%. The lysine-rich moiety was precipitated at 45% concentration of ethanol.

Moving-boundary electrophoresis (Spinco Model H electrophoresis-diffusion instrument with the Philpot-Svensson optical system) was conducted on the unfractionated histones over a wide range of values for pH, ionic strength, and protein concentration. Maximum resolution into five components was attained at pH 5.3 - 5.5, 0.05 ionic strength, and 0.5% protein concentration.

Chromatography of the lysine- and arginine-rich histones on the barium form of Amberlite IRC - 50 was carried out according to Crampton, et al. (*J. Biol. Chem.*, 211, 907 (1954)). Neither fraction showed significant contamination with the other. Both fractions appeared heterogeneous, but resolution was poor.

Moving-boundary electrophoresis was conducted on both fractions separately at pH 5.5 and 9.3. In each case, the buffer ionic strength was 0.05 and the histone concentration 0.5%. At the acid pH, both histone fractions were found to be composed of four distinct components. The principal component of the lysine-rich histone was found to have the highest mobility. Electrophoretic studies were carried out on a synthetic 1:1 mixture of the lysine- and arginine-rich fractions at pH 5.5, 0.05 ionic strength, and

total protein concentration of 0.5%. The mixture was resolved electrophoretically into four components. The electrophoretic mobilities of the fast components of both the synthetic mixture and of the unfractionated histone closely approximated the mobility of the principal component of the lysine-rich histone.

It is concluded that the component of highest electrophoretic mobility in the unfractionated calf thymus histones is the principal component of the lysine-rich fraction. It is further concluded that the unfractionated protein is probably composed of at least eight different molecular species. Microfilm \$2.75; Xerox \$7.20. 151 pages.

PHYSICAL CHANGES OF FIBRINOGEN FREE
LOW GLOBULIN HUMAN PLASMA
PROTEIN SOLUTIONS FOLLOWING EXPOSURE
TO DIFFERENT TEMPERATURES
FOR VARIOUS LENGTHS OF TIME

(L. C. Card No. Mic 61-283)

Edward Hanly Mealey, Ph.D.
University of Kansas, 1960

The virus of homologous serum hepatitis has been shown to be transmitted by human plasma transfusions. Clinical studies have shown this virus was inactivated by heating for ten hours at 60°C. Whole plasma cannot be heated for this length of time without the formation of a precipitate. With these facts in mind a study of the physical changes due to heating was made on several different plasma protein solutions.

Different ethanol concentrations, hydrogen ion concentrations and temperatures were used to remove the Fraction II+III proteins from human plasma in preparation of human plasma protein solutions. When the ethanol concentrations were less than 25 percent, and the temperatures were higher than -5°C, at a constant pH of 6.8, the plasma protein solutions following 10 hours heating at 60°C showed a new component in the electrophoretic patterns, an increased amount of very fast moving component in the ultracentrifuge and an increase in optical density. When an ethanol concentration of 25 percent, a temperature of -5°C and a pH of 6.8 was used, the α_1 and α_2 globulin components of the plasma protein solutions heated for 10 hours at 60°C were not resolvable in the electrophoretic patterns. These heated solutions showed much less of the fast moving component in the ultracentrifuge and much less change in optical density. The changes observed in stabilized plasma protein solutions on heating for 10 hours at 60°C were the same whether or not the protein solutions were in their normal plasma electrolyte environment. When the ethanol concentrations used to remove the Fraction II+III proteins were increased to as high as 35 percent and the pH decreased below 6.8 at a constant temperature of -5°C, the plasma protein solutions following heating for 10 hours at 60°C showed less change in the electrophoretic patterns and less fast moving component in the ultracentrifuge. The yield of albumin did not decrease at 35 percent ethanol but at 40 percent ethanol the yield of albumin did decrease.

The chemical stabilizers, acetyl-dl-tryptophanate and caprylate tended to decrease the changes observed in the

plasma protein solutions heated for 10 hours at 60°C. This stabilizing effect was more pronounced in solutions heated up to 200 hours at 60°C. The same was true for solutions stored at 4°, 20°, and 37°C for periods up to 2 years. The large amount of fast moving component observed in the ultracentrifuge in plasma protein solutions of low heat stability following 10 hours heating at 60°C was markedly reduced by the addition of stabilizers prior to heating.

Studies employing solutions of the individual fractions separated from both heated and unheated Method H solutions and combinations of these fractions showed that the changes observed in the electrophoretic patterns and ultracentrifugal diagrams of Method H solutions following 10 hours heating at 60°C were due primarily to the change in the α globulin components of Fraction IV-4. Small changes of albumin and β globulin might have occurred also.

Plasma protein solutions heated for 10 hours at 60°C lost some of their antigenic activity but no antigen foreign to the unheated solutions was found.

On the basis of these studies one can conclude that plasma protein solutions of reasonably good heat stability can be obtained from human plasma. In all cases changes do occur in some of the proteins when the solutions are heated at 60°C for ten hours.

Microfilm \$2.75; Xerox \$7.40. 159 pages.

BIOSYNTHESIS OF β -GALACTOSIDASE

(L. C. Card No. Mic 61-59)

Ivan S. Palmer, Ph.D.
The Pennsylvania State University, 1960

The induced biosynthesis of β -galactosidase in *Escherichia coli* was studied in the presence of two types of inhibitors, namely, an amino acid analog and various energy sources. All of the studies involved the use of resting cells, i.e., cells which cannot grow because of lack of nitrogen or energy.

It was shown that the amino acid analog, p-fluorophenylalanine, did not inhibit β -galactosidase synthesis induced by 0.8% lactose. Moreover, the analog was actually incorporated into cellular proteins. This was demonstrated with unlabeled analog and also with radioactive analog. Cells exposed to 0.01 M analog during a 3.5 hour induction experiment, incorporated an amount of analog equivalent to 20% of the total phenylalanine in *E. coli* cells. It was concluded that this represented more incorporation than could be explained by synthesis of β -galactosidase alone. The data were interpreted as indicating that either there was cellular protein turnover at an approximate rate of 6% per hour or else that the presence of lactose caused the induction of many proteins other than β -galactosidase.

The analog was found to stimulate β -galactosidase synthesis in cells which were exposed to 0.8% lactose. The data suggest that the analog may increase the instability of other cellular protein and/or inhibit other synthetic reactions which could compete with the β -galactosidase system.

In other studies, it was demonstrated that the presence of the analog did inhibit enzyme synthesis when a low

inducer concentration (0.01%) was employed. The reasons for this effect at low inducer concentrations are not understood.

β -galactosidase synthesis was shown to occur in nitrogen-free medium. Furthermore, it was demonstrated that under the conditions employed, more enzyme was synthesized in the absence of both exogenous sources of energy and nitrogen than in the presence of added energy. It was concluded that endogenous sources of energy and nitrogen are sufficient for enzyme synthesis.

Studies were undertaken to determine whether or not glucose was the only energy source that would completely inhibit the biosynthesis of β -galactosidase. Xylose, glycerol and ribose were found to give complete inhibition if cells were adapted to these energy sources prior to induction of β -galactosidase synthesis. Partial induction of β -galactosidase before addition of the energy source was not effective in preventing inhibition of enzyme synthesis by the energy source.

In a continuation of these studies it was found that cells which were exposed to inducer and a limited amount of exogenous energy source, overcame inhibition of enzyme synthesis after a period of time. A simultaneous study of enzyme synthesis and oxygen evolution in such a system revealed a sharp break in the rate of oxygen uptake coincident with the end of enzyme inhibition. The data suggest that the exogenous energy sources are all metabolized to a common intermediate which represses enzyme synthesis. It was concluded that the repressor may be a metabolite between glycerol and acetate in the usual catabolic scheme.

Microfilm \$2.75; Xerox \$4.00. 73 pages.

AERATION IN FERMENTATIONS

(L. C. Card No. Mic 61-660)

Donald Howard Phillips, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Marvin J. Johnson

Methods for Measurement of Dissolved Oxygen. Three methods for measurement of dissolved oxygen in fermentations have been investigated; the tubing method, the probe method and the microelectrode method. In the tubing method, a coil of Teflon tubing was immersed in the fermentor. A slow stream of pure nitrogen was passed through the tubing and into a sensitive oxygen analyzer. Some of the oxygen in the fermentation diffused through the Teflon and the oxygen content of the effluent gas from the tubing was proportional to the oxygen tension in the medium. This method is probably the most accurate and reliable method available for measurement of dissolved oxygen in fermentations. For the probe method, a steam-sterilizable oxygen probe was developed. This device contained two silver electrodes immersed in a small volume of a 0.75N KCl solution. The KCl solution was separated from the medium by a 0.005 inch thick Teflon membrane. A potential of about 0.7 volts was applied between the electrodes. The current drawn by the probe was proportional to the oxygen tension in the medium. This method was practical and convenient for measurement in actual fermentations. In the microelectrode

method, a potential of about 0.4 volts was applied between a very small platinum microelectrode and the fermentor (which was grounded). The current drawn by the microelectrode was measured (as a voltage drop across a suitable resistor) with an oscilloscope. With this method, the instantaneous dissolved oxygen tension at one point in the fermentor could be recorded. This device showed considerable polarization in fermentations and as a result, it could be used for only a short time in fermentations.

Aeration in Fermentations. Oxygen transfer in *Aerobacter aerogenes*, *Escherichia coli*, *Azotobacter vinelandii*, *Aspergillus niger* and *Penicillium chrysogenum* fermentations was studied. In the bacterial fermentations, symptoms of oxygen deficiency occurred when the dissolved oxygen tension fell to 0.01 to 0.02 atmospheres. With mold, oxygen deficiency was apparent at measured dissolved oxygen tensions of 0.07 to 0.15 atmospheres. The true critical oxygen tension for the mold cultures was about 0.01 atmospheres. Tremendous variations in dissolved oxygen due to poor bulk mixing apparently caused the poor correlation between the apparent and true critical oxygen tension in the mold fermentations.

Aeration efficiencies of a 3.5-liter and 1900-liter fermentor were evaluated with the sulfite method and compared with aeration efficiencies in fermentations. No correlation between the oxygen uptake rate of sulfite solutions and the maximum oxygen uptake rate in fermentations was observed.

Considerations on Fermentor Design. Basic equations to describe aeration in fermentations have been derived. On the basis of these equations, optimum bubble size is dependent on fermentor height and much higher aeration efficiencies are possible in short fermentors if the gas hold-up is constant. It appears that modern production fermentors are not ideally designed.

Microfilm \$2.75; Xerox \$7.80. 167 pages.

THE GLYCOLIPIDS OF ALGAE

(L. C. Card No. Mic 61-67)

Isao Shibuya, Ph.D.
The Pennsylvania State University, 1960

This thesis describes a study of the chemistry and metabolism of major glycolipids of algae. These are the mono- and digalactosyl glycerides and the plant sulfolipid, a sulfolipid glyceride.

C^{14} -Labeled lipids of nine species of red and green algae were prepared by photosynthesis in $C^{14}O_2$ during 5 to 10 hours. The lipids were extracted, separated from water-soluble components and deacylated by base-catalyzed methanolysis. The deacylation products of three glycolipids and six phosphatides were identified on two-dimensional paper chromatograms. Their relative concentrations were determined by measuring the C^{14} activities of their spots. Mono- and digalactosyl glycerides and the sulfolipid were found predominant in all algae investigated. The lipid compositions of algae were correlated with those of higher plants.

Floridoside was isolated from the water-soluble fraction of the extracts from all species of red algae. A marine red alga, *Porphyra umbilicalis*, contained

isofloridoside in addition to the floridoside. The structures of these free α -galactosyl glycerols were confirmed by use of specific galactosidases and by periodate oxidation procedures. Since neither an α -galactolipid nor a free β -galactosyl glycerol was detected in the algal extracts, the mechanisms of biosynthesis of the α - and β -galactosyl glycerols must be unrelated to each other. Floridoside was found to undergo a transgalactosidation in the presence of acid to give free glycerol and a homologous series of polygalactosyl glycerols, suggesting a possible role of the free galactosyl glycerols for the biosynthesis of algal polygalactoside-derivatives.

Several definitive experiments provided evidence for the structure of the sulfosugar. The acid hydrolysis product of S^{35} -labeled sulfolipid gave sulfoacetaldehyde upon periodate oxidation. The deacylated sulfolipid gave sulfolactic acid by periodate oxidation followed by acid hydrolysis and nitrogen dioxide oxidation. Both results indicated the 6-deoxyaldohexopyranosyl 6-sulfonic acid structure for the original sulfolipid. S^{35} -Labeled sulfoacetic, sulfolactic, sulfo-pyruvic acids, sulfoacetaldehyde and their derivatives were synthesized by new or modified methods for use as standard materials in the structural and metabolic studies of the compounds related to the sulfolipid.

The incorporation rate of radiosulfate into the sulfolipid by *Scenedesmus* cells was measured. One or two minutes sufficed for accumulation of detectable radioactivity in the lipid. This increased rapidly during 5 hours and then decreased to one-tenth of its maximum value after 70 hours of the cultivation. The activities of other sulfur-containing components of the algal cells were also measured and the data obtained were discussed in connection with the unique turnover of the sulfolipid activity. The biosynthetic mechanism for the sulfolipid was examined by searching for possible biosynthetic intermediates. The deacylated form of the sulfolipid was found in the extracts of *Scenedesmus*. Since neither the free sulfosugar nor possible precursors, such as its high-energy derivatives, thiosugar and thiolipid, were detected in the algal extracts, C-S bond formation was suspected to take place after the formation of a monoglycosyl monoglyceride.

Formation of inorganic sulfate from the deacylated sulfolipid by intact *Scenedesmus* cells was described, and the presence of a new enzyme system which liberates inorganic sulfate from sulfonic acid derivatives was suggested. By intact algal cells a new sulfonic acid derivative was formed from the sulfosugar. Two new sulfur-containing lipid compounds were isolated from S^{35} -*Scenedesmus*. They were stable to peroxidation and one changed into the other by acid heating.

In the course of the syntheses of sulfonic acid derivatives, cysteic acid was found to undergo a unique deamination reaction with ninhydrin at pH values above 3 to give sulfoenolpyruvic acid, whereas at pH 1, decarboxylation occurred in addition to the oxidative deamination. The effects of the sulfonic acid group and the acidity of the medium on the ninhydrin reaction were discussed in the appendix. Microfilm \$2.75; Xerox \$4.00. 71 pages.

SYNTHESIS OF 1-SUBSTITUTED ANALOGS OF THYMIDINE

(L. C. Card No. Mic 60-5315)

Robert Charles Smith, Ph.D.
University of Illinois,
Chicago Professional Colleges, 1960

The method of Gearien and Binkley (1) was adapted for the synthesis of 1-substituted thymines. They were prepared by reacting primary amines with methyl methacrylate to form methyl N-substituted- β -aminoisobutyrate. These compounds were converted to 1-substituted dihydrothymines by treatment with potassium cyanate and hydrochloric acid followed by cyclization. Treatment of the 1-substituted dihydrothymines with bromine in glacial acetic acid gave the 1-substituted thymines. Using this procedure the following new 1-substituted dihydrothymines and 1-substituted thymines were prepared:

1-Benzyl-dihydrothymine
1-Isopropyl-dihydrothymine
1-Methyl-dihydrothymine
1-Furfuryl-dihydrothymine
1-Isopropylthymine

In addition two other 1-substituted thymines, 1-benzyl and 1-methylthymine, previously reported in the literature, were prepared by this method. 1-Furfurylthymine was prepared by the cyclization of 1-furfuryl-3- β -methoxy- α -methylacrylylurea prepared from the reaction of furfurylamine and β -methoxy- α -methylacrylyl isocyanate.

The 1-benzyl, 1-isopropyl, and 1-methylthymines prepared were converted to the corresponding 1-substituted-4-thiothymines by treatment with phosphorous pentasulfide in pyridine (2). The three thiothymines were used to synthesize 1-substituted-5-methylcytosines by the reaction of the thio compounds with methanolic ammonia in a sealed tube (2).

Two 1-tetraacetylglucopyranosyl-3-acrylylureas were prepared by the method of Gabel and Binkley (3). They are:

1-(2',3',4',6'-tetraacetylglucopyranosyl)-3-acrylylurea
1-2'(2'-deoxy-2',3',4',6'-tetraacetylglucopyranosyl)-3-acrylylurea.

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Microfilm \$2.75; Xerox \$4.80. 93 pages.

CHEMISTRY, INORGANIC

LOWER OXIDATION STATES
OF ZIRCONIUM

(L. C. Card No. Mic 60-6646)

Willie Arthur Baker, Jr., Ph.D.
The University of Texas, 1959

Supervisor: George W. Watt

An investigation was made of possible methods for the preparation of zirconium(IV) iodide. It was found that the best method for the synthesis was through the direct combination of the elements at 400° in a flow system.

Once a method for the preparation of the iodide had been established, several possible methods for reducing it to a lower iodide were investigated. In an effort to determine if reduction with potassium in liquid ammonia was possible, the behavior of zirconium(IV) iodide in the solvent was studied and it was determined that complete ammonolysis took place in a very short time, thus precluding the possibility of this method for reduction.

The behavior of zirconium(IV) iodide in an electrodeless discharge using a variety of gaseous atmospheres was also studied. No reaction was observed with helium, hydrogen, or carbon monoxide, but with other oxygen-containing gases such as sulfur dioxide and nitric oxide, the zirconium was converted almost quantitatively to the oxide. With sulfur dioxide, other products observed were sulfur, iodine, and sulfur monoxide, while with nitric oxide, iodine, pentoxide, and nitrogen dioxide were observed. In the presence of acetylene and ethylene, the zirconium(IV) iodide was decomposed to the metal while an appreciable amount of iodine-containing organic material was obtained from the polymerization of the gas. No reduction to lower iodides was observed with any of the gases in the discharge.

The effect of sodium borohydride and lithium aluminum hydride on zirconium(IV) iodide was studied under a variety of conditions, and reaction was observed to take place in some instances. The data seemed to indicate that actual reduction was accomplished, although attempts at separation and isolation of the reduced species were not successful. Vacuum sublimation failed to yield any volatile products and attempts at solvent extraction were thwarted by experimental difficulties.

Reductions were carried out using iron and aluminum as reducing metals. The reactions were carried out in sealed and evacuated tubes which were heated to 300-400° for periods ranging up to several weeks. The volatile iodides formed were sublimed under reduced pressure leaving a residue of lower zirconium iodides. In this way, zirconium(III) iodide contaminated by only small amounts of aluminum or iron was obtained. No pure iodide of zirconium(II) was ever isolated although mixtures of what seemed to be zirconium(II) and zirconium(III) iodides were prepared using aluminum to reduce the zirconium(IV).

Microfilm \$2.75; Xerox \$4.40. 85 pages.

A STUDY OF THE THERMAL DECOMPOSITION
OF SOME CHROMIUM (III) AND
COBALT (III) AMMINE COMPLEXES

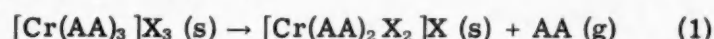
(L. C. Card No. Mic 60-5517)

John LaRue Bear, Ph.D.
Texas Technological College, 1960

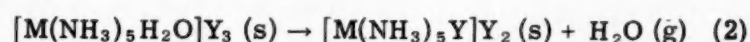
Chairman: Wesley W. Wendlandt

Thermal decomposition processes for some chromium (III) and cobalt (III) ammine complexes were studied, using an autometric recording thermobalance, differential thermal analysis apparatus, and a manometric apparatus. Decomposition patterns were established and the kinetic data of reaction order and activation energy were determined for some of the decomposition reactions. Catalyst effects of some ammonium salts on several of the decomposition reactions were established.

Ammine and diamine complexes of Cr(III) and Co(III) were included in this study. Emphasis was placed on the decomposition reactions:



and



(where M is Co(III) or Cr(III), X is Cl⁻ or SCN⁻, AA is ethylenediamine or 1,2-propylenediamine, and Y is Cl⁻, Br⁻, I⁻, or NO₃⁻).

The catalytic effect of ammonium salts was established for reaction (1). Reaction order and activation energies were determined for reaction (2).

Microfilm \$2.75; Xerox \$8.00. 173 pages.

POLARIZED CRYSTAL SPECTRA
OF TRANSITION METAL IONS

(L. C. Card No. Mic 61-96)

Richard Lewis Carlin, Ph.D.
University of Illinois, 1960

Large single crystals of the colorless diluent compounds NaMgAl(C₂O₄)₃·8H₂O and aluminum acetylacetonate have been grown with part of the aluminum isomorphously replaced with the trivalent ions of titanium, vanadium, chromium, manganese, iron, and cobalt. The visible spectra of these crystals have been investigated at both room and liquid nitrogen temperatures with polarized light. It has been shown that such spectra are valuable for the assignment of the electronic structures of transition metal ions. In particular, the effect of the resolution of degeneracies by a trigonal field has been investigated and shown that in these particular crystals the electronic selection rules are obeyed.

The spectra have also been of value in elucidating the nature of the weak spin forbidden lines. Such intercombination transitions have been shown to be electric dipolar in nature, just as the spin allowed bands have previously been shown to be.

Furthermore, the source of intensity in the spectra of the tris-oxalatometallates has been clarified. An electronic

mechanism dependent only on the trigonal symmetry of the crystalline field has been found. Further evidence for this mechanism is found in the stronger intensities of absorption bands as the temperature is lowered.

The spectra of the metal acetyl acetonates have been shown to depend in large measure on strong covalent interaction between the metal atom and the chelate ring.

Microfilm \$2.75; Xerox \$3.00. 58 pages.

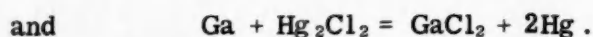
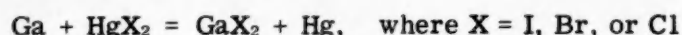
A NEW METHOD FOR THE PREPARATION OF GALLIUM DIHALIDES AND SOME OBSERVATIONS ON THEIR PROPERTIES

(L. C. Card No. Mic 61-271)

Richard Charles Carlston, Ph.D.
University of Kansas, 1960

The nature of the lower oxidation states of the Group IIIA elements has remained obscure until recently. The discovery^{1,2} that the gallium dihalides are best represented as $Ga^I Ga^{III} X_4$ and not as $X_2 Ga-GaX_2$ has clarified the situation. The present study shows that the chemical properties of the gallium dihalides are in accord with this formulation: the two gallium atoms in the formula above react differently.

As a first step, a convenient synthetic method for the dihalides was established. The following reactions go quantitatively in a sealed tube:



Each reaction was carried out by heating the mixture a few degrees above the melting point of the dihalide for two hours. The products were identical with those reported in the literature.

Reaction between gallium and a mercury halide proceeds more rapidly when an aromatic hydrocarbon is used as a solvent. For example, mercury(I) chloride is only slowly attacked by gallium at 40°C, but in the presence of benzene, the mercury(I) salt disappears in a few minutes.

Although the properties of the dihalides prepared by the dry method indicate that these compounds are the same as those which have been previously reported, the solid compounds isolated from the benzene preparations are new: $GaGaCl_4 \cdot C_6H_6$ and $GaGaBr_4 \cdot C_6H_6$. The benzene could not be removed without charring. These compounds are highly soluble in benzene and the solubility reported for gallium dichloride in benzene (1.25 mole percent Ga_2Cl_4)³ could be exceeded by a factor of twenty. Concentrated solutions of the bromide and chloride formed two-layer systems which coalesced at higher temperatures. The bottom layer is much richer in dihalide.

Evidence was obtained to indicate that when benzene was used as the solvent gallium did not react with the mercury chlorides to give the dichloride directly. A yellow intermediate solution containing mercury(I), gallium(III), and chlorine appeared to play a prominent role. Solids and solutions could be prepared which had an approximate mole ratio corresponding to $HgGaCl_4$ and displayed chemical properties similar to those of the

known compound $HgAlCl_4$.⁴ These intermediate materials were easily prepared by using mercury halide in excess over that used for the dichloride synthesis. The yellow color of the intermediate solution faded on contact with excess gallium metal, and the solution which resulted underwent hydrolysis in the same manner as a dichloride solution. The intermediate solution described above was more diamagnetic than benzene, indicating that the mercury(I) chlorogallate(III) was dimerized, as is usual for mercury(I) salts. The ease with which gallium replaces mercury in the chlorogallate is indicative that gallium dichloride is a chlorogallate.

Hydrogen sulfide reacted with benzene solutions of gallium dichloride to precipitate half the gallium as a white sulfide. Half the gallium remained in solution as gallium(III) chloride. Hydrogen chloride was evolved during the reaction. The sulfide precipitate was of variable composition and exhibited reducing power beyond that expected for sulfide ion. The solid contained gallium, sulfur, chlorine, hydrogen and carbon although these five elements did not account for the total weight of the solid. Chlorine could not be removed from the solid. It appears that the solid is primarily $GaHS$ with large amounts of chloride trapped in the solid. This sulfide has not been previously reported. The observed reaction with hydrogen sulfide is consistent with the formulation of the dichloride as gallium(I) chlorogallate(III).

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Microfilm \$2.75; Xerox \$5.80. 116 pages.

ETHYLENEDIAMINE COMPLEXES OF PALLADIUM

(L. C. Card No. Mic 60-6648)

Richard Layton, Ph.D.
The University of Texas, 1959

Supervisor: Dr. George W. Watt

Bisethylenediaminepalladium(II) iodide was reduced to metallic palladium when treated with potassium in liquid ammonia at its boiling point. Reaction with potassium amide in liquid ammonia at its boiling point produced $[Pd(en)(en-H)]I$ and $[Pd(en-H)_2]^0$.

The properties of these latter compounds were studied extensively. The complex, $[Pd(en)(en-H)]I$, was shown by absorption spectra measurements, and potentiometric titrations with HI and $K_2[HgI_4]$ to react slowly with water to produce $[Pd(en)_2]^{++}$. Further data were obtained from the absorption spectrum in ethanol and liquid ammonia at room temperature. The stability of air-exposed and unexposed $[Pd(en)(en-H)]I$ was investigated by thermal decomposition.

The properties of $[\text{Pd}(\text{en}-\text{H})_2]^0$ were investigated by the same methods as $[\text{Pd}(\text{en})(\text{en}-\text{H})]\text{I}$. In contrast to the latter complex, $[\text{Pd}(\text{en}-\text{H})_2]^0$ was found to have strong base characteristics.

The structure of the complexes of the type mentioned above was discussed and correlated with observed properties. Microfilm \$2.75; Xerox \$3.00. 59 pages.

THE PHOSPHATES OF COMPLEX CATIONS

(L. C. Card No. Mic 60-3297)

Elliott Raisen, Ph.D.
University of Cincinnati, 1960

Study has been made of the precipitation from aqueous solutions of five phosphate anions - orthophosphate, pyrophosphate, triphosphate, trimetaphosphate, and tetrametaphosphate, present as their sodium salts - by complex metal cations, usually as their chlorides. The results are presented in extensive tables, and have been analyzed with a view to establishing general principles governing water - insolubility of the phosphates of complex cations, and to finding selective precipitants for the individual phosphates. The insoluble phosphates of the tris(propylenediamine)-platinum (IV) ion have been characterized in detail, and their possible utilization in the analysis of phosphate mixtures evaluated.

Forty-two different, cationically complex, metal salts were used in the work. Nineteen were synthesized by us; of these, three specifically, $[\text{Pt}(\text{dien})(\text{H}_2\text{O})]\text{Cl}_2$, $[\text{Pt}(\text{tpn})_2]\text{Cl}_2$ and $[\text{Pt}(\text{tpn})_2]\text{Cl}_4$ - were previously unknown.* $[\text{Pt}(\text{tpn})_2]\text{Cl}_2$ is an example of the rare class of 6-coordinate platinum (II) complexes. In preparing many of the complex salts, quite novel methods or useful modifications of established procedures were worked out. New information on the tridentate amine, 1,2,3-triaminopropane, was obtained.

The behavior (self-pH, and stability against spontaneous precipitation at pH's 4, 7, and 10) of aqueous solutions, usually 0.3N, of thirty-seven of the complex metal salts were studied. The patterns of precipitation from water solutions of the five phosphates - and, in addition, sodium metaphosphate glass, sodium alkyl sulfonate, sodium alkyl benzenesulfonate, sodium sulfate, and sodium silicate - by twenty-seven different complex metal ions were determined at pH's 4, 7 and 10. These patterns are difficult to interpret but several useful generalizations are proposed. Solubility of the phosphates of complex cations is often critically dependent on pH. Salts of ortho- and trimetaphosphate tend to greater solubility than those of pyro-, tri-, and tetrametaphosphate. With the hexamine ions - $[\text{MA}_6]^{n+}$, $[\text{M}(\text{BB})_3]^{n+}$, and $[\text{M}(\text{CCC})_2]^{n+}$ - the tendency to precipitate phosphates gradually decreases as the number of carbon atoms in the complex increases. Decreasing the charge on a complex cation by substituting negative ions for neutral molecules increases the solubility of its phosphates.

Four new, relatively insoluble, salts of the $[\text{Pt}(\text{pn})_3]^{4+}$ ion* - $[\text{Pt}(\text{pn})_3][\text{P}_2\text{O}_7]$, $[\text{Pt}(\text{pn})_3][\text{HP}_3\text{O}_{10}]$, $[\text{Pt}(\text{pn})_3][(\text{PO}_3)_3][\text{Cl}]$, and $[\text{Pt}(\text{pn})_3][(\text{PO}_3)_4]$ - have been characterized and evaluated as precipitating forms for the various phosphates in analytical work. Of these, only $[\text{Pt}(\text{pn})_3]$

$[(\text{PO}_3)_4]$ forms readily, is very insoluble, and is easily handled; it may well be useful in the separation of tetrameta- from ortho- and/or trimetaphosphate for the quantitative estimation of tetrametaphosphate.

*dien = diethylenetriamine, tpn = 1,2,3-triaminopropane, pn = propylenediamine.

Microfilm \$2.75; Xerox \$5.80. 116 pages.

THERMAL DECOMPOSITION OF TRIS(ETHYLENEDIAMINE)CHROMIUM(III) CHLORIDE

(L. C. Card No. Mic 61-427)

Michael Rock, Ph.D.
University of Maryland, 1960

Supervisor: Professor Carl L. Rollinson

The catalyzed thermal conversion of tris(ethylenediamine)chromium(III) chloride to cis-dichloro-bis(ethylenediamine)chromium(III) chloride has been investigated by means of three heating methods, namely heating in an oven, heating in boiling organic liquids in which the chromium compounds are insoluble, and heating in a gas stream in a glass reaction vessel. Special attention has been given to reaction media, minimum amounts of catalyst required and the effects of temperature and water. The reaction was studied in the non-oxidizing media nitrogen and organic liquids and in the oxidizing media air and oxygen. Several questions arising from previous investigations have been answered, and a quite complete description of the reaction can now be presented.

Only incomplete knowledge of the reaction can be obtained by the oven method alone since the thermal decomposition is complicated by competing oxidation reactions leading to charring of the product. Conversion of $[\text{Cren}_3]\text{Cl}_3$ to cis- $[\text{Cren}_2\text{Cl}_2]\text{Cl}$, however, is the predominant reaction if sufficient catalyst, e.g. NH_4Cl , is present.

By means of the boiling organic liquid method, it was discovered that very small amounts of catalyst are sufficient. The sensitivity of the method is due primarily to the fact that it provides an inert atmosphere and thus prevents competitive oxidative reactions. It also permits following the reaction even when its rate is very low since the ethylenediamine evolved may be collected and titrated.

The liquid originally used in this method was tetralin in which it appeared that samples of $[\text{Cren}_3]\text{Cl}_3$ containing no catalyst were converted to cis- $[\text{Cren}_2\text{Cl}_2]\text{Cl}$. After considerable investigation of tetralin in attempts to find catalytic impurities, it was found that the samples of $[\text{Cren}_3]\text{Cl}_3$ initially used actually contained catalyst, in amounts too small to be detectable except by their catalytic effect. It was shown that recrystallization from hydrochloric acid solution (the method used with the samples in question) forms enough catalyst, probably ethylenediamine hydrochloride, for the reaction to occur in a non-oxidizing medium.

Samples of $[\text{Cren}_3]\text{Cl}_3$ containing so little catalyst that they do not appear to be decomposing when heated in an oven at 210° can be completely converted to cis- $[\text{Cren}_2\text{Cl}_2]\text{Cl}$ in boiling liquids such as tetralin, triethylbenzene

and trichlorobenzene. The amount of ethylenediamine hydrochloride in such samples of $[\text{Cren}_3]\text{Cl}_3$ is too small to be determined by the usual analytical methods. However, by heating very pure $[\text{Cren}_3]\text{Cl}_3$ in triethylbenzene to which a known amount of anhydrous hydrogen chloride had been added, the order of magnitude of the effective amount was established.

Rates of decomposition were also investigated by means of a glass reactor in which samples could be heated in a gas stream. This method also showed that only small quantities of catalyst are required, if an inert gas such as nitrogen is used, while the results are obscured by competitive oxidation reactions if oxygen is used. The effect of catalyst concentration, temperature and gas flow rate were also studied.

Although water is not essential it increases the rate of decomposition as shown by experiments in which $[\text{Cren}_3]\text{Cl}_3$ was heated in the reactor through which steam or nitrogen saturated with water vapor was passed. This may indicate that it acts here as a Lewis acid.

On the basis of the information now available, the thermal decomposition is interpreted as an acid-base reaction in which $[\text{Cren}_3]\text{Cl}_3$ as a base reacts with a solid acid such as ammonium chloride or an amine hydrochloride. The amine, or NH_3 , is displaced by ethylenediamine early in the reaction and thereafter ethylenediamine hydrochloride is the catalyst.

Microfilm \$2.75; Xerox \$6.00. 123 pages.

LOWER OXIDATION STATE STUDIES: COBALT AND RHENIUM.

(L. C. Card No. Mic 60-6652)

Richard John Thompson, Ph.D.
The University of Texas, 1959

Supervisor: Dr. George W. Watt

Iodopentamminecobalt(III) iodide, in contrast to its iridium analog but like the corresponding rhodium compound, gives the metal on reduction with potassium in liquid ammonia. The cobalt thus formed is very pyrophoric.

The yellow precipitate formed by treating $\text{K}_3[\text{Co}(\text{CN})_6]$ with two moles of potassium in liquid ammonia was shown to be $\text{K}_3[\text{Co}(\text{CN})_4]$. This material is highly reactive, and sensitive to both oxygen and moisture.

New equipment was designed and found to be highly satisfactory for carrying out reactions or titrations in liquid ammonia. Because of proper annealing permitted by the all-glass construction, this type of vessel has proven to be very sturdy.

In boiling ammonia, K_2ReBr_6 undergoes ammonolysis with the consumption of 6.14 moles of ammonia per mole of salt; insoluble species were not detected.

In liquid ammonia at room temperature (sealed tube) K_2ReBr_6 undergoes ammonolysis to yield a black product which cannot be freed of contaminating salts by repeated leaching with liquid ammonia.

In liquid ammonia the reaction of K_2ReBr_6 with potassium amide yields an insoluble black product containing all the rhenium and none of the bromine. This material could

not be obtained in a pure state and appeared to be the same as the product obtained by the reaction of K_2ReBr_6 with a solution of potassium in liquid ammonia for which like analytical data were found. X-Ray diffraction data for both reaction products, and the -33°C . ammonolysis product, are substantially identical.

In hot dimethylformamide, dissolved K_2ReCl_6 reacts with the solvent to precipitate essentially all the calculated KCl (2 moles).

In boiling liquid ammonia ReI_3 undergoes ammonolysis with the consumption of 6.15 moles of NH_3 , but insoluble products are not formed. A solution of ReI_3 in liquid ammonia reacts with KNH_2 to give a black, insoluble, iodine- and potassium-free product containing all the rhenium. The amount of rhenium found in this product is in agreement with that calculated for $\text{Re}(\text{NH}_2)_3$, a compound that has not been reported previously.

Microfilm \$2.75; Xerox \$4.60. 86 pages.

CHEMISTRY, ORGANIC

AN APPROACH TO THE SYNTHESIS OF COLCHICINE

(L. C. Card No. Mic 61-243)

Terese Ellen Acker, Ph.D.
Columbia University, 1960

The synthetic studies that are described in this work involve a number of reaction schemes that were attempted in order to build up a bicyclic 2,3,4-trimethoxy-8,9-dihydro-5-R-7H-benzocycloheptene system of such structure that it could serve as the carbon frame for the construction of the alkaloid Colchicine. In order for this to be possible it was necessary for the group substituted at position 5 to be suitably functionalized so as to allow for the further elaboration necessary to make the tropolone ring. This work concludes with the description of the total synthesis and the characterization of 2,3,4-trimethoxy-8,9-dihydro-5-acetaldehyde-7H-benzocyclohepten-6-one ethylene ketal. This reactive compound should be transformable into Colchicine by means of a Robinson type tropinone ring formation.

Microfilm \$2.75; Xerox \$4.60. 90 pages.

NEIGHBORING GROUP PARTICIPATION IN SOME CYCLIC SULFIDES

(L. C. Card No. Mic 61-77)

Donald James Anderson, Ph.D.
University of Illinois, 1960

The solvolytic reactivity of several chlorosulfides has been studied in aqueous dioxane media. Their relative first-order solvolysis rates at 95°C . in a medium of Y -value 1.3415 are: 3-chlorothietane, $2.7 \times 10^8 >$ 2-(chloromethyl)-thiophane, $3.8 \times 10^7 >$ 3-thiacyclohexyl

chloride, $7.4 \times 10^6 >$ ethyl β -chloroethyl sulfide, $2.1 \times 10^6 >$ 2-(chloromethyl)-thiirane, $1.2 \times 10^5 >$ 3-chlorothio-phane, $270 >$ 4-thiacyclohexyl chloride, 1.0. On this reactivity scale, the values for cyclopentyl and cyclohexyl chloride are 350 and 24 respectively. Thus we conclude that except for 4-thiacyclohexyl chloride, the chlorosulfide solvolyses are anchimerically assisted, the intermediates being cyclic or bicyclic sulfonium ions.

The compounds 3-thiacyclohexyl chloride and 2-(chloromethyl)-thiophane give the same solvolysis product, 3-thiacyclohexanol. Similarly, 3-chlorothietane and 2-(chloromethyl)-thiirane yield 3-thietanol.

Lithium perchlorate special salt effects have been demonstrated in 70 per cent aqueous dioxane for the compounds 3-chlorothietane and ethyl β -chloroethylsulfide. For the latter compound, such effects persist even in 50 per cent aqueous dioxane.

The ketones 3-thiacyclohexanone, 3-thiophanone and 3-thietanone have been examined spectrally for cross-ring electronic interactions. All three compounds exhibit an anomalous band at $250 \text{ m}\mu$ which is possibly a result of an electronic interaction in the excited state between the sulfur atom and the carbonyl system. Only the thietane derivative provides evidence of an electronic interaction in the ground state. Its infrared spectrum shows two carbonyl absorptions, the lower frequency band increasing in intensity with increasing solvent polarity.

Microfilm \$4.15; Xerox \$14.65. 323 pages.

SOME INVESTIGATIONS OF ALDOL-TYPE CONDENSATIONS OF PHTHALIDES

(L. C. Card No. Mic 60-6440)

Roger Donald Barry, Ph.D.
University of Cincinnati, 1960

The aldol-type condensation of phthalide with aromatic aldehydes was investigated and it was found that the major products from this reaction were the two diastereoisomeric 3-(α -hydroxybenzyl)phthalides. Attempts were made to evaluate the yields of the diastereoisomers and thus gain some information concerning the stereochemistry of the aldol condensation. Although the yields, as determined by separation of the diastereoisomers by chromatography, were not exact enough to permit a stringent interpretation of the mechanism of this reaction they do agree with the theoretical predictions.

From an examination of the amount of phthalide recovered from the reaction with benzaldehyde, anisaldehyde and o-tolualdehyde in methanolic sodium methoxide the rate determining step is believed to be the addition of the phthalide anion to the aldehyde carbonyl carbon atom.

The other product from this reaction was found to be the 2-substituted-1,3-indanedione and it was formed only in small amounts. An increase in the reaction temperature, however, increased the yield of this compound.

As an extension of this study the aldol reaction of 6-nitrophthalide with aromatic aldehydes, using piperidine as the catalyst, was investigated for several aldehydes, the reaction being found to be very general for aromatic aldehydes. Phthalide could not be condensed with aromatic aldehydes using piperidine as the catalyst.

The reaction of phthalide with more than one molar equivalent of benzaldehyde in the presence of methanolic sodium methoxide was found to yield an unexpected compound which is believed to be 2,4-diphenyl-3-hydroxy-3-(2-carboxyphenyl)oxetane, lactone, on the basis of its physical and chemical properties.

The use of methanolic sodium methoxide as the basic catalyst for the aldol condensation of γ -butyrolactone with aromatic aldehydes was found to be very good in many cases.

The ultra-violet and infra-red spectra were determined for many of the phthalides which were prepared. Some spectral correlations were found.

The reaction of phthalide with aromatic aldehydes in methanolic sodium methoxide, giving the 3-(α -hydroxybenzyl)phthalides, is contrary to some reports in the literature which state that phthalide cannot be condensed with aromatic aldehydes.

The following new compounds were prepared: 4-benzyl-7-nitrophthalaz-1-01, 4-N-(4-nitrobenzenesulfonylamino)-phthalide, 3-(4-methylbenzylidene)-6-nitrophthalide, 3-(4-hydroxybenzylidene)-6-nitrophthalide, 3-(2-nitrobenzylidene)-6-nitrophthalide, 3-(3-nitrobenzylidene)-6-nitrophthalide, 3-(4-nitrobenzylidene)-6-nitrophthalide, 3-(4-isopropylbenzylidene), 3-(3-methoxy-4-hydroxybenzylidene)-6-nitrophthalide, 3-(4-diethylaminobenzylidene)-6-nitrophthalide, 3-(1-naphthylidene)-6-nitrophthalide, 3-(2-furfurylidene)-6-nitrophthalide, erythro 3-(α -acetoxybenzyl)phthalide, threo-3-(α -acetoxybenzyl)phthalide, erythro-3-(α -hydroxy-2-methylbenzyl)phthalide, erythro-3-(α -acetoxy-2-methylbenzyl)phthalide, threo-3-(α -hydroxy-2-methylbenzyl)phthalide, threo-3-(α -acetoxy-2-methylbenzyl)phthalide, 3-benzylidene-6-cyanophthalide.

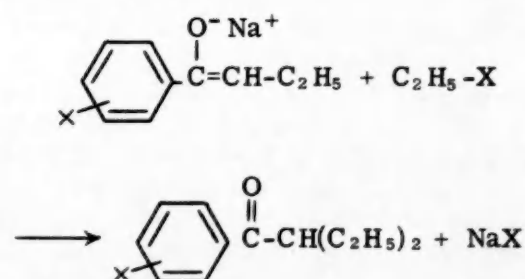
Microfilm \$3.75; Xerox \$13.30. 292 pages.

THE KINETICS AND MECHANISM OF THE ETHYLATION OF SUBSTITUTED α -SODIIBUTYROPHENONES

(L. C. Card No. Mic 60-3289)

Fred William Breitbeil III, Ph.D.
University of Cincinnati, 1960

The problem was to elucidate further the mechanism for the C-alkylation of arylalkyl ketone enolates by a study of substituent effects on the rate of ethylation substituted butyrophenone enolates.



The sodium enolates (0.1 M) were prepared under an atmosphere of nitrogen by treatment of the ketones with triphenylmethyl sodium in diethyl ether or tetrahydrofuran.

The homogeneous solutions were made 1.72 M in ethyl halide. Reaction samples were withdrawn at various time intervals and were quenched in water. The unreacted enolate decomposes immediately into starting ketone and sodium hydroxide. The hydroxide was titrated with standardized nitric acid and the decrease in concentration of enolate was calculated. The reaction followed pseudo-first-order kinetics.

It was demonstrated that α -sodiobutyrophenone derivatives exist essentially in an enol form in the ground state and in non-polar solvents they are aggregated. Ethylation of α -sodiobutyrophenone gave no evidence of C-alkylation. From the linearity of the enthalpy and entropy of activation relationship, it was assumed that all other 3- and 4-substituted butyrophenone enolates gave only the C-alkylated product. Evidence for a concerted mechanism, sensitive to substituent inductive effects, was obtained from non-linear Hammett plots. That this concerted process is a delicate balance of bond forming and breaking processes was demonstrated by a comparison of substituent rate ratios. Solvent, salt, cation, and proximity effects were presented as evidence for a polar activated complex with specific steric requirements. Finally, distinct linear enthalpy and entropy of activation relationships among electron donating and withdrawing groups confirms the existence of a concerted mechanism, where the substituent controls the rate dominating process in the activated complex.

Although a study of O- vs. C-alkylation was not directly the object of this research, an explanation was advanced to account for some O-alkylation observed in the ethylation of the tetralone enolate. Forced coplanarity of the functional sidechain permits a delocalization of π -electrons into the benzene nucleus. This should give more free ionic character to the oxygen-sodium ion pair. The increased freedom in the ion pair makes the oxygen atom a nucleophilic center and O-alkylation results. The delocalization of π -electrons into the benzene nucleus, caused by forced coplanarity, was confirmed by the ultraviolet and infrared spectral shifts for the 2,4-dinitrophenylhydrazones and enolate derivatives of tetralone when compared with the same derivatives for butyrophenone.

Microfilm \$2.75; Xerox \$5.60. 111 pages.

REACTION OF 1,1-DIPHENYL-2-NITROETHYLENE WITH STRONG BASE.

(L. C. Card No. Mic 60-6661)

Charles David Broadus, Ph.D.
The University of Florida, 1960

1,1-Diphenyl-2-nitroethylene(I) was found to produce a benzophenone(III), 1,3-dinitro-2,2-diphenylpropane(V), isobutylene(VI), and 1,1,4,4-tetraphenylbutatriene(IX) when reacted with the strong base potassium *t*-butoxide. These products were accounted for on the basis of two competing reactions. One involved a β -addition of the butoxide ion to the starting material, followed by decomposition of the resulting adduct to benzophenone(III), isobutylene(VI), and nitromethane anion(IV). This anion could have added to 1,1-diphenyl-2-nitroethylene to produce 1,3-dinitro-2,2-diphenylpropane(V). The other reaction

involved a proton transfer from the starting material to the basic potassium *t*-butoxide to produce a vinyl carbanion. This carbanion could have undergone α -addition to 1,1-diphenyl-2-nitroethylene. The resulting adduct could have then undergone a series of β -elimination reactions to produce 1,1,4,4-tetraphenylbutatriene(IX).

Microfilm \$2.75; Xerox \$3.00. 46 pages.

A STUDY OF THE FERROCENYL GROUP AS A SUBSTITUENT

(L. C. Card No. Mic 60-6980)

Allen Keith Clark, Ph.D.
The University of North Carolina, 1960

Supervisor: William F. Little

A number of compounds in a series of ferrocenyl substituted azobenzenes were prepared and the ultraviolet and visible spectra were obtained for purposes of interpreting resonance effects of the ferrocenyl substituent on the azo substrate. The spectra indicate that the ferrocenyl group acts as an electron-donating substituent and that the resonance interaction of the ferrocenyl group is large.

A mechanism is proposed for the arylation of the ferricinium ion in aqueous solution.

The Grignard reagent of *p*-bromophenylferrocene was prepared and used in some preparative reactions including carbonation, hydrolysis, and reaction with a carbonyl compound.

Displacement of the bromine on the *p*-bromophenylferrocenium ion with piperidine was attempted but was not successful. Starting material was recovered from the reaction.

Diazotization of *m*-aminophenylferrocene was attempted but was not successful. No products were isolated from attempted coupling reactions or deamination.

Microfilm \$2.75; Xerox \$4.20. 76 pages.

THE MECHANISM OF THE CLEAVAGE OF SECONDARY ALCOHOLS BY CHROMIC ACID

(L. C. Card No. Mic 60-5354)

William H. Clement, Ph.D.
University of Delaware, 1960

Supervisor: W. A. Mosher

A series of para-substituted phenyl-*t*-butylcarbinols have been synthesized, and their rates of oxidation by chromic acid in 86.5% acetic acid have been determined. The data obtained have correlated very well using the Hammett relationship, and a negative rho value has been calculated for the Hammett curve. The cleavage percentages for the chromic acid oxidations of the substituted carbinols have also been ascertained. In the absence of additives or in the presence of low concentrations of sodium acetate, the para-methoxy compound has led to the highest aldehyde yields.

The rate of chromic acid oxidation for 1-deutero-1-p-anisyl-2,2-dimethyl-propanol-1 has been found to be about one-tenth that for the ordinary carbinol, thus indicating rupture of a C-H (or C-D) bond in the rate controlling step.

An induced air oxidation step has been detected during the Cr (VI) oxidations of cleavable carbinols at conditions of rather high cleavage. The rates of oxidation of phenyl-t-butylcarbinol have been faster in the absence of oxygen.

Both phenyl-t-butylcarbinol and p-anisyl-t-butylcarbinol have been reacted with Fenton's Reagent, a one-electron transfer oxidant, and cleavages greater than those obtained with chromic acid have resulted. These same carbinols have been cleaved to aldehyde almost quantitatively by cerium (IV) ion.

Chromic acid oxidation of phenyl-t-butylcarbinol or p-anisyl-t-butylcarbinol in the presence of acrylonitrile has led to the formation of polyacrylonitrile. This has provided evidence for the existence of free radicals during these oxidations, but attempts to identify the radicals have failed.

The addition of manganous ion to Cr (VI) oxidations of p-anisyl-t-butylcarbinol has failed to eliminate the C-C fission products. However, it has been found that the manganese dioxide which forms during the reaction is itself capable of oxidizing and cleaving the anisyl carbinol under the experimental conditions.

Treatment of phenyl-t-butyl ketone with Caro's acid has yielded benzoic acid; the product has resulted from a splitting-off of the t-butyl group.

The experimental data have indicated that p-anisyl-t-butylcarbinol is oxidized by chromic acid in the same manner as phenyl-t-butylcarbinol. A modification of the Westheimer cleavage mechanism has been proposed to account for the observed oxygen effects and for the free radicals detected; the modified mechanism has been shown to be consistent with the known facts. A discussion concerning the nature of the cleavage step has also been presented. Microfilm \$2.75; Xerox \$4.60. 87 pages.

THE CHEMISTRY OF SOME
 α -(4-SUBSTITUTED BENZYLIDENE)-
 γ -BUTYROLACTONES

(L. C. Card No. Mic 60-3291)

Ralph Edward DeBrunner, Ph.D.
University of Cincinnati, 1960

A number of α -(4-substituted benzylidene)- and α -(4-substituted benzyl)- γ -butyrolactones were synthesized for evaluation as cancer chemotherapeutic agents. During the preparation of these compounds some new and useful knowledge of the chemistry of α -benzylidene- γ -butyrolactone and of the α -(4-substituted benzylidene)- γ -butyrolactones, particularly α -(4-aminobenzylidene)- γ -butyrolactone, was obtained.

The direct introduction of a functional group into the aromatic ring of α -benzylidene- γ -butyrolactone by a method other than nitration and chlorosulfonation, for example chloromethylation, was found to be unsatisfactory, evidently due to the deactivated character of the phenyl ring. The difficulty could be circumvented to some degree

by the development of several reactions involving the amino group of α -(4-aminobenzylidene)- γ -butyrolactone. By means of a Sandmeyer reaction the amine was converted to the nitrile, which in turn was hydrolyzed under appropriate conditions to the corresponding acid amide and carboxylic acid. The nitrile was also converted to the corresponding aldehyde by a Stephen reaction.

α -(4-Aminobenzylidene)- γ -butyrolactone, though evidently too weakly basic to undergo direct alkylation with alkyl halides, condensed with formaldehyde and potassium cyanide to give the N-cyanomethyl compound. This reaction opened up the way to prepare a glycine whose nitrogen atom was substituted with a derivative containing a lactone ring. The N-substituted glycine was available by the hydrolysis of the cyanomethylated amine.

When α -benzylidene- γ -butyrolactone was heated with primary amines the lactone was converted to the N-substituted pyrrolidones. For example, α -benzylidene- γ -butyrolactone was converted to 1-phenyl-3-benzylidene-2-pyrrolidone when heated with aniline to 200°C. in a sealed bottle. It seems that this reaction could be extended to all unsubstituted primary amines if a sufficiently high temperature is used.

The following new compounds were prepared: α -bromo, α -(α -bromo-4-methylbenzyl)- γ -butyrolactone; α -(4-formylbenzylidene)- γ -butyrolactone; 2-[4-(p-dimethylaminophenyl)-azobenzylidene]-4-hydroxybutyric acid, γ -lactone; 2-[4-(β -hydroxy- α -naphthyl)-azobenzylidene]-4-hydroxybutyric acid, γ -lactone; 2-[4-(β -hydroxy- α -naphthyl)-azobenzylidene]-4-hydroxybutyric acid, γ -lactone; α -(4-cyanobenzylidene)- γ -butyrolactone; α -(4-cyanobenzyl)- γ -butyrolactone; α -(4-carbamoylbenzylidene)- γ -butyrolactone; α -(4-carbamoylbenzyl)- γ -butyrolactone; α -(4-carboxybenzylidene)- γ -butyrolactone; α -(4-carboxybenzyl)- γ -butyrolactone; α -(4-acetamidomethylbenzyl)- γ -butyrolactone; α -(4-cyanomethylaminobenzylidene)- γ -butyrolactone; α -(4-carbamoylmethylaminobenzylidene)- γ -butyrolactone; α -(4-carbamoylmethylaminobenzyl)- γ -butyrolactone; α -(4-carboxymethylaminobenzyl)- γ -butyrolactone; α -(4-carboxymethylaminobenzylidene)- γ -butyrolactone; methylene-N,N-bis-[α -(4-aminobenzylidene)- γ -butyrolactone]; α -(4-methylaminobenzyl)- γ -butyrolactone, trimer; 1-phenyl-3-benzylidene-2-pyrrolidone; and 1-(β -naphthyl)-3-benzylidene-2-pyrrolidone. Microfilm \$2.75; Xerox \$6.20. 128 pages.

STUDIES CONCERNING THE MECHANISM
OF THE ALKYL GROUP REARRANGEMENT
OF n-PROPYLBENZENE AND
p-n-PROPYLTOLUENE

(L. C. Card No. Mic 60-6647)

James Edward Douglass, Ph.D.
The University of Texas, 1959

Supervisor: Dr. Royston M. Roberts

Roberts and Brandenberger¹ have reported that n-propyl- β -C¹⁴-benzene rearranges in the presence of aluminum chloride to n-propyl- α -C¹⁴-benzene. A mechanism was proposed which involved a symmetrical π -complex with the terminal methyl group bridged across the α - and β -carbon atoms of the n-propyl group.

The present study extended the above work to a more detailed investigation of the rearrangement reaction. All of the findings supported the Roberts-Brandenberger mechanism. *n*-Propylbenzene, initially labeled in either the α - or the β -positions, upon continued treatment with aluminum chloride approached an equal distribution of radioactivity between the α - and β -carbon atoms with increasing reaction time, thereby indicating an equivalency of the two positions during the course of the reaction.

The small amount (ca. 3 per cent) of isopropylbenzene which was formed during the reaction was isolated, and the distribution of radioactivity in the isopropyl group was determined. The distribution of labeling between the α - and β -positions of the iso- and *n*-propylbenzenes was found in one case to be 31-69 per cent and 67-33 per cent, respectively, thus indicating an inverse relationship between the distribution of labeling in the two isomers. Furthermore, the distribution of carbon-14 in the isopropylbenzene approached equality with increasing reaction time. All of these facts can be explained in terms of the Roberts-Brandenberger mechanism.

Several other interesting facts were discovered. Water, for example, had a marked effect on the catalytic activity of aluminum chloride. Maximum catalytic activity was observed at a 0.5 mole ratio of water to aluminum chloride which gave 38.8 per cent isotopic rearrangement; the activity was essentially zero at a 2.0 ratio and was inferred to be zero at a ratio of zero. Also, aluminum bromide functioned as a catalyst for the rearrangement equally as well as aluminum chloride. Water-activated aluminum bromide (0.5 mole ratio) gave 38.5 per cent rearrangement, while aluminum bromide-hydrogen bromide (1.0 mole ratio) gave 44.3 per cent, the latter being the greatest percentage of rearrangement effected in any single reaction.

Roberts and Brandenberger¹ have suggested that a 1,2-shift on the aromatic ring may be an integral part of the mechanism of the rearrangement. A study of the behavior of *p*-*n*-propyl- α -C¹⁴-toluene failed to prove or disprove this possibility.

1. R. M. Roberts and S. G. Brandenberger, *J. Am. Chem. Soc.*, **79**, 5484 (1957).
Microfilm \$2.75; Xerox \$8.00. 173 pages.

THE SYNTHESIS OF
SOME AMINE SUBSTITUTED PHENOLS
RELATED TO DIETHYLSTILBESTROL
AND OTHER KNOWN
CARCINOSTATIC AGENTS

(L. C. Card No. Mic 61-296)

James Allen Ellard, Ph.D.
University of Kentucky, 1956

Director: Dr. J. R. Meadow

This study was undertaken to provide a closely related series of compounds of the stilbene, hydrobenzoin, benzil, and bibenzyl type, containing hydroxyl groups on the *para* positions and substituted aminomethyl groups in the *meta* positions to the two-carbon bridge. These compounds

were prepared for study as possible carcinostatic or carcinolytic agents.

The choice of these compounds for study was based on the well-known effectiveness of diethylstilbestrol for the control of prostate cancer. There is some evidence to indicate that this effectiveness is not derived solely from the estrogenic properties of diethylstilbestrol. If the estrogenic and carcinostatic properties of this compound are independent, a study of related compounds might lead to the discovery of compounds of enhanced carcinostatic power as well as reduced estrogenic activity. The feminization of the patient is an unpleasant and perhaps unnecessary consequence of diethylstilbestrol therapy.

These compounds were prepared by introduction of the substituted aminomethyl groups into the phenols by means of the Mannich reaction. The introduction of the Mannich groups was suggested by the fact that the Mannich derivatives of a number of substituted *bis*(4-hydroxyphenyl)-ethers, ketones, and sulfones had been shown to possess carcinostatic activity.

The hydrobenzoines were prepared by electrolytic reduction of the corresponding benzaldehydes, except 3,3'-diacetamido-4,4'-dihydroxyhydrobenzoin, which was prepared by nitration, reduction, and acetylation of 4,4'-dihydroxyhydrobenzoin. 4,4'-Dihydroxystilbene, 3,3'-dichloro-4,4'-dihydroxystilbene, and 4,4'-dihydroxy-3,3'-dinitrostilbene were prepared in good yield by reduction of the hydrobenzoines with hydriodic acid and hypophosphorous acid, and 3,3'-diacetamido-4,4'-dihydroxystilbene by reduction and acetylation of the nitrostilbene. 3,3'-Diethoxy-4,4'-dihydroxystilbene and 4,4'-dihydroxy-3,3'-dimethoxystilbene were prepared by reduction of the hydrobenzoines with zinc and hydrochloric acid in ethanol solution, presumably by pinacol rearrangement, reduction, and dehydration with simultaneous retropinacol rearrangement. Neither of these reductions have previously been applied to hydrobenzoines. The benzils were prepared by oxidation of the hydrobenzoines with cupric hydroxide in acetic acid solution, and the bibenzyl by catalytic reduction of the corresponding stilbene.

In the course of this work ten phenols were prepared which have not been previously reported. These were 3,3'-diacetamido-4,4'-dihydroxystilbene, 3,3'-diamino-4,4'-dihydroxystilbene, 3,3'-dichloro-4,4'-dihydroxystilbene, 3,3'-diethoxy-4,4'-dihydroxystilbene, 4,4'-dihydroxy-3,3'-dinitrostilbene, 3,3'-diacetamido-4,4'-dihydroxyhydrobenzoin, 3,3'-diamino-4,4'-dihydroxyhydrobenzoin, 3,3'-dichloro-4,4'-dihydroxyhydrobenzoin, 4,4'-dihydroxy-3,3'-dinitrohydrobenzoin, and 3,3'-diethoxy-4,4'-dihydroxybenzil.

Thirty eight previously unreported disubstituted Mannich derivatives have been prepared, and evidence has been presented which indicates that these derivatives are symmetrically substituted. These are the morpholine and piperidine derivatives of diethylstilbestrol, 4,4'-dihydroxystilbene, 3,3'-dichloro-4,4'-dihydroxystilbene, 3,3'-diethoxy-4,4'-dihydroxystilbene, 4,4'-dihydroxy-3,3'-dimethoxystilbene, 4,4'-dihydroxyhydrobenzoin, 3,3'-dichloro-4,4'-dihydroxyhydrobenzoin, 3,3'-diethoxy-4,4'-dihydroxyhydrobenzoin, 4,4'-dihydroxy-3,3'-dimethoxyhydrobenzoin, 3,3'-diethoxy-4,4'-dihydroxybenzil, and 4,4'-dihydroxy-3,3'-dimethoxybenzil; the dimethylamine derivatives of diethylstilbestrol, 4,4'-dihydroxystilbene, 3,3'-dichloro-4,4'-dihydroxystilbene, 3,3'-diethoxy-4,4'-dihydroxystilbene, and 4,4'-dihydroxy-3,3'-dimethoxystilbene;

the pyrrolidine and N-methylpiperazine derivatives of 4,4'-dihydroxystilbene, 3,3'-diethoxy-4,4'-dihydroxyhydrobenzoin, and 4,4'-dihydroxy-3,3'-dimethoxyhydrobenzoin; the diethylamine derivatives of 4,4'-dihydroxystilbene and 3,3'-diethoxy-4,4'-dihydroxystilbene; the piperidine derivatives of 3,3'-diacetamido-4,4'-dihydroxystilbene and 3,3'-diacetamido-4,4'-dihydroxyhydrobenzoin; and the morpholine derivative of 4,4'-dihydroxy-3,3'-dimethoxybibenzyl. In addition, 3,3',5,5'-tetrakis(piperidinomethyl)-4,4'-dihydroxystilbene was prepared.

A brief examination of the course of the Mannich reaction was undertaken, and evidence was presented to the effect that under the conditions employed, phenols which are engaged in hydrogen bonding enter into the reaction only to a slight extent even under forcing conditions. A mechanism which is consistent with this observation has been proposed.

Many of these compounds have been submitted to Dr. C. F. Geschickter of the Georgetown University Medical Center for determination of their toxicities and further physiological studies.

Microfilm \$2.75; Xerox \$5.00. 100 pages.

THE SYNTHESIS AND DEHYDRATION OF HIGHLY BRANCHED ALCOHOLS: A STUDY OF CARBON-SKELETON REARRANGEMENTS.

(L. C. Card No. Mic 60-5357)

Ross Wade Fasick, Ph.D.
University of Delaware, 1960

Supervisor: W. A. Mosher

The synthesis and acid-catalyzed dehydration of several highly branched alcohols are reported. The work was carried out for the purpose of studying group migrations in carbonium ion systems. The alcohols prepared and dehydrated were 3,4-dimethyl-4-phenyl-2-pentanol (I), 2,3-dimethyl-3-phenyl-2-pentanol (II), 2,3-dimethyl-2-phenyl-3-pentanol (III), 4,4-dimethyl-2-phenyl-3-pentanol (IV), 4-methyl-4-phenyl-2-pentanol (V), 3-methyl-3-phenyl-2-pentanol (VI), and 4,4-dimethyl-3-ethyl-2-pentanol (VII).

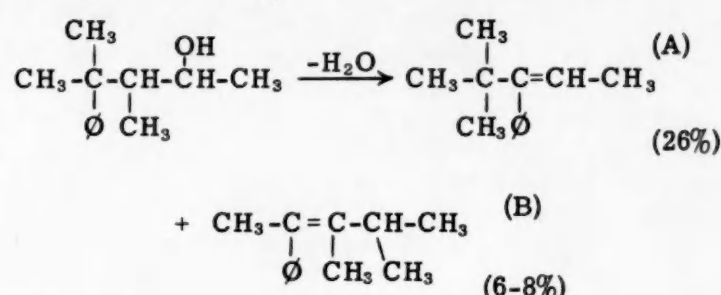
Alcohols I and III were prepared by the reactions of cumyl potassium with 2,3-epoxybutane and butanone-2, respectively, II and VI by the reaction of α -phenyl-sec-butyl potassium with acetone and with acetaldehyde, IV by the reaction of α -phenylpropionaldehyde with t-butylmagnesium chloride, V by the reaction of neophylmagnesium chloride with acetaldehyde, and VII by the hydroboration of 4,4-dimethyl-3-ethyl-2-pentene.

The dehydrations were carried out at 80 to 100°C. and 1-2 mm pressure using concentrated sulfuric acid as the dehydrating catalyst and removing the olefinic products as rapidly as possible in order to minimize isomerization. The olefin mixtures were resolved by gas chromatography, and the structures of the individual isomers determined by a combination of infrared analysis and the standard ozonization technique.

The dehydration of I gave a mixture of 3,4-dimethyl-4-phenyl-2-pentene (60%), 3,4-dimethyl-4-phenyl-1-pentene (5%), 4,4-dimethyl-3-phenyl-2-pentene (26%),

3,4-dimethyl-2-phenyl-2-pentene (6-8%), and 2,4-dimethyl-3-phenyl-2-pentene (1-2%). The composition of the olefin mixture was altered by further exposure to acid at the dehydration temperature, giving more 4,4-dimethyl-3-phenyl-2-pentene and less unrearranged product. Dehydration with iodine in acetic acid gave the unrearranged product initially. By the time the reaction neared completion the olefin distribution was very similar to that from the sulfuric acid reaction.

Two of the products of the dehydration represent unanticipated rearrangements:



B is the product of consecutive 1,2-methyl shifts. The ratio of B to 2,4-dimethyl-3-phenyl-2-pentene indicates a preferential methyl over phenyl shift following the initial 1,2-methyl shift. Neophyl alcohol, however, gave only β,β -dimethylstyrene upon dehydration under the same conditions. Olefin (A) could have resulted from either of two sequences of group migrations: (1) by a 1,3-phenyl shift, followed by consecutive 1,2-methyl and 1,2-phenyl shifts in the reverse direction, or (2) by a 1,2-hydride migration, followed by a positional exchange of a phenyl and methyl group. Evidence in support of (2) is presented.

Dehydration of 2,3-dimethyl-2-phenyl-3-pentanol gave an 85:15 mixture of 3,4-dimethyl-4-phenyl-2-pentene and 4,4-dimethyl-3-phenyl-2-pentene. The ratio of unrearranged product to A was lowered by further exposure to the acidic reaction medium. 2,3-Dimethyl-3-phenyl-2-pentanol gave 98% unrearranged olefin on dehydration with sulfuric acid. Treatment of the pure olefin with acid at 100° for thirty minutes gave 12-15% 4,4-dimethyl-3-phenyl-2-pentene, A.

Dehydration of 4-methyl-4-phenyl-2-pentanol gave a mixture of 4-methyl-4-phenyl-2-pentene, 3-methyl-2-phenyl-2-pentene, and 2-methyl-3-phenyl-2-pentene in the ratio 94:5:1. This represents another example of preferential methyl over phenyl migration.

3-Methyl-3-phenyl-2-pentanol gave a mixture of three olefins in the ratio 4:68:28. These compounds were identified as 4-methyl-3-phenyl-2-pentene, 2-methyl-3-phenyl-2-pentene, and 3-methyl-2-phenyl-2-pentene, respectively.

4,4-Dimethyl-2-phenyl-3-pentanol gave a mixture of at least three olefinic hydrocarbons, only two of which were identified. At least 80% of the total olefin mixture was 2,3-dimethyl-4-phenyl-2-pentene and 3,4-dimethyl-2-phenyl-2-pentene. No 4,4-dimethyl-2-phenyl-2-pentene was isolated.

Microfilm \$2.75; Xerox \$6.00. 121 pages.

REACTIONS OF DIBORON TETRACHLORIDE WITH ORGANIC COMPOUNDS

(L. C. Card No. Mic 61-37)

William Burke Fox, Ph.D.

The Pennsylvania State University, 1960

The present research was undertaken in order to investigate the reactions of diboron tetrachloride with more complex organic molecules and functional groups than heretofore studied, with the intention of broadening existing knowledge of the chemical behavior of the boron-boron bond. In the course of the investigations, attention was given principally to the reactions of diboron tetrachloride with amines, nitriles, carbonyl compounds, cyclic ethers, organic sulfur compounds, and aromatic compounds. Reactions with 2-chloroethanol, nitromethane, and methyl ether were briefly studied.

Reactions of diboron tetrachloride with methylamine and ethylenediamine resulted in chlorine displacement and produced, respectively, $B_2(NHCH_3)_4$ and $[B_2(NCH_2CH_2N)]_x$. Reaction of the tetrachloride with ethyleneimine caused polymerization of the latter compound.

Diboron tetrachloride reacted with acetonitrile and hydrogen cyanide to form the Lewis adducts $B_2Cl_4 \cdot 2CH_3CN$ and $B_2Cl_4 \cdot 2HCN$. Displacement of the base content of the former adduct was effected by treatment with trimethylamine, but similar treatment of $B_2Cl_4 \cdot 2HCN$ resulted in polymerization of the adduct. The properties of $BCl_3 \cdot HCN$ were also investigated.

The behavior of diboron tetrachloride with carbonyl compounds was determined by the electron-withdrawing ability of substituents adjacent to the carbonyl group. Phosgene did not react with diboron tetrachloride, and acetyl chloride only formed an easily dissociated 1:1 adduct. Acetone formed a 1:1 and a 2:1 adduct with the tetrachloride, both of which decomposed in complex fashion to produce chlorinated organic materials, hydrogen chloride, and trichloroborane. Acetaldehyde reacted to form high yields of bis(1-chloroethyl) ether and boron monoxide.

Ethylene oxide was readily cleaved by diboron tetrachloride to produce 2-chloroethoxy diboron compounds, the extent of chlorine displacement depending on reaction conditions. Tetrahydrofuran behaved similarly.

Thermal decomposition of the dietherate $B_2Cl_4 \cdot 2(CH_3)_2O$ cleaved the ether and produced (after heating to $115^\circ C$.) nearly quantitative yields of boron monoxide and methyl chloride. In contrast to this behavior, pyrolysis of dialkyl sulfide adducts (methyl and ethyl) of diboron tetrachloride at $160^\circ C$. produced only negligible amounts of the alkyl chlorides and led to disproportionation of the boron compound to $BCl_3 \cdot R_2S$ and $BCl \cdot R_2S$.

Methanethiol and diboron tetrachloride reacted at low temperature to form the isolable adduct $B_2Cl_4 \cdot 2CH_3SH$. In the absence of excess reagents, this material decomposed at room temperature to hydrogen chloride and $B_2Cl_2(SCH_3)_2$. Treatment of diboron tetrachloride with excess methanethiol at room temperature resulted in quantitative cleavage of boron-boron bond, producing hydrogen and CH_3SBCl_2 .

Diboron tetrachloride did not react with benzene, although interaction of a decomposition product, $(BCl)_n$, with benzene afforded (slowly, at room temperature) good yields of phenyldichloroborane. With naphthalene, diboron

tetrachloride rapidly formed an easily dissociated molecular complex; over a period of several weeks at room temperature, further reaction produced (irreversibly) 1,2,3,4-tetrakis(dichloroboryl)-1,2,3,4-tetrahydronaphthalene.

Nitromethane and diboron tetrachloride reacted explosively above $-80^\circ C$., producing a complex mixture of solids and gases. An experiment with nitromethane and trichloroborane led to the formation of $BCl_3 \cdot 2CH_3NO_2$.

Microfilm \$2.75; Xerox \$8.80. 191 pages.

THE DETERMINATION OF THE ABSOLUTE CONFIGURATION OF AN ALLENE

(L. C. Card No. Mic 60-6689)

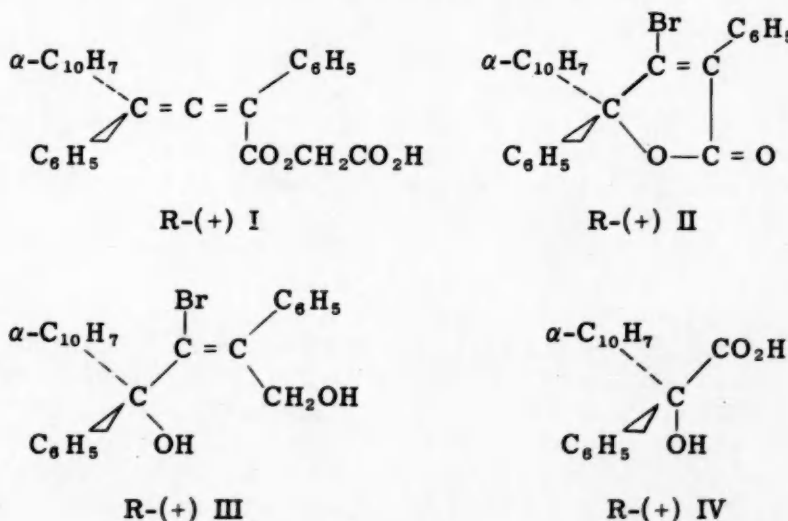
Michael Harry Gianni, Ph.D.

University of New Hampshire, 1961

The glycolic acid ester of α, γ -diphenyl- γ -(1-naphthyl)-allene- α -carboxylic acid (I) was synthesized according to the method of Kohler, Walker and Tishler in an over-all yield of 7.7% and was resolved into its optical antipodes for the purpose of determining its absolute configuration.

It was found that this allene was converted stereospecifically by bromine to α, γ -diphenyl- γ -(1-naphthyl)- β -bromocrotonolactone (II). The attempted ozonolysis of this lactone to obtain α -naphthylmandelic acid (IV) failed. The lactone was reduced to 1,3-diphenyl-1-(α -naphthyl)-2-bromo-2-butene-1,4-diol (III), ozonolysis of which also failed to give α -naphthylmandelic acid.

The optical rotatory dispersion curves of the lactone II and the diol III were compared with that of an authentic sample of R-(+) α -naphthylmandelic acid (IV). It was found that the dextrorotatory isomers of all three compounds showed positive single Cotton effects. On the basis of the R-(+) assignment to IV, the R-(+) configurations have been assigned to II and III. As a consequence of the assignment of the R-(+) configuration to the lactone II and its stereospecific formation from the allene I, the R-(+) configuration has been assigned to the allene I.



Microfilm \$2.75; Xerox \$3.60. 65 pages.

THE KOLBE ELECTROLYSIS AS A SOURCE
OF FREE RADICALS IN SOLUTION

(L. C. Card No. Mic 60-6688)

Hans-Georg Gilde, Ph.D.
Ohio University, 1961

Director: William B. Smith

The Kolbe electrosynthesis as a potential source of free radicals has been studied in the presence of various radical acceptors.

The electrolysis of a methanolic solution of potassium acetate in the presence of butadiene produced a complex mixture of reaction products. From the low-boiling material, *trans*-3-hexene (no *cis* isomer), 3-methyl-1-pentene and 1-pentene (no 2-pentene) were isolated. The higher-boiling material, following hydrogenation and reduction of the acetate esters with lithium aluminum hydride, was chromatographed over alumina to give a hydrocarbon fraction and an alcoholic fraction.

A combination of vapor phase chromatography and infrared spectroscopy showed the hydrocarbon to consist primarily of *n*-decane and 3-ethyloctane. Similarly, the alcoholic fraction was shown to be composed of butyl alcohol, pentyl alcohol and 2-methyl-1-butanol.

With potassium propionate as the electrolyte, electrolysis in the presence of butadiene produced the *trans* isomer, only, of 4-octene. By replacing the butadiene with isoprene and again electrolyzing potassium acetate an even more complex mixture of products resulted. The lower-boiling hydrocarbon was shown to contain *cis*-3-methyl-3-hexene, while the higher-boiling component consisted of a mixture of C_{12} hydrocarbons.

The stereochemistry of this electrode process was investigated by electrolyzing optically active sodium α -methylbutyrate in the presence of butadiene. The hydrocarbon fraction, primarily $C_{16}H_{30}$, was isolated and shown to be racemic. Upon ozonolysis, this material gave 3-methylvaleric acid which was likewise optically inactive.

This study was extended by electrolyzing potassium acetate in the presence of 1,3-cyclohexadiene. Following work-up of the reaction product by the procedure described above, analysis revealed the presence of cyclohexane, methylcyclohexane, *cis* and *trans* isomers of 1,2- and 1,4-dimethylcyclohexane, 2-methylcyclohexanol and methyl-substituted cyclohexyl methyl ethers.

Polymerization of such monomers as vinyl acetate, methyl methacrylate and vinyl chloride was successfully initiated by Kolbe electrolysis intermediates. When potassium acetate- $2-C^{14}$ was the electrolyte, the polymers obtained were radioactive. In addition it was found that the degree of polymerization is inversely proportional to the current density.

From these studies it was concluded that free radicals are generated during the electrolysis and that these readily add to dienes and vinyl monomers to induce further reaction. The radical acceptors appear to be adsorbed on the surface of the electrode in their most stable configuration, whereas the generated radicals are not bound to the surface of the electrodes in a configuration-holding interaction.

Microfilm \$2.75; Xerox \$4.00. 74 pages.

THE KINETICS OF THE REACTION
OF PHENYL ISOCYANATE
WITH 1-BUTANETHIOL

(L. C. Card No. Mic 60-5358)

John Franklin Glenn, Ph.D.
University of Delaware, 1960

Supervisor: Elizabeth Dyer

The kinetics of the base-catalyzed reaction of phenyl isocyanate with 1-butanethiol at 25° in a solvent were investigated by a dilatometric method. The reaction follows approximate second order kinetics with a slight increase in rate in the later stages, due to product-catalysis. The effects of concentration of isocyanate, ratio of isocyanate to thiol, nature of added product, polarity of solvent and concentration and type of amine were studied.

The rate constant for the reaction at 0.25M isocyanate concentration was approximately 1.36 times that at 0.075M isocyanate concentration, for solutions in toluene containing the same amount of triethyl amine catalyst. Varying the ratio of isocyanate to thiol from 1:1 to 1:5 had little effect on the rate constant. At very high ratios, for example 1:23, the reaction became pseudo first order.

Proof that the reaction was product-catalyzed was obtained by adding *n*-butylthiolcarbanilate at the start of the reaction, when the rate was increased in proportion to the amount of product added and the rate curve for the determination became approximately a straight line. If butyl *N,N* diphenyl thiolcarbamate was added to the reaction mixture, no effect on rate was noted. This indicated that the amide hydrogen of the normal product, *n*-butylthiolcarbanilate, is involved in the catalysis by the product.

In solvents such as dimethyl formamide and dimethyl sulfoxide, the reaction was exceedingly fast with no amine present. On the other hand, these two solvents when used in catalytic amounts did not display good efficiency. The reaction using triethyl amine was quite slow when acetonitrile was used as the solvent; the rate constant was approximately 10^{-6} . Reactions measured in butyl acetate were about 3 times faster than in toluene, the usual solvent, and those measured in nitrobenzene were about 200 times as fast as in toluene.

A number of amines were employed as catalysts for this reaction. In all cases the rate constant was directly proportional to the concentration of the amine. The catalytic efficiency of the amine varied with the base strength and the steric nature of the nitrogen atom. In a Bronsted plot of the log catalytic rate constant vs. pK_b , the sterically normal amines, triethyl amine, 1-ethylpiperidine, 1-methylpiperidine, *N*-ethylmorpholine and pyridine showed a direct relationship of the base strength to the catalytic rate constant. Those amines which were more hindered, tri-butyl amine, tri-propyl amine and 1,2,2,6,6 pentamethylpiperidine fell below the normal line where they should have been in accordance with their base strength. On the other hand, the sterically favored amines, benzyl dimethyl amine and 1,4 diaza (2.2.2)-bicyclooctane showed considerable enhancement of rate over what would be expected from their base strength. Diethyl aniline exhibited little or no catalytic properties for this reaction.

The mechanism proposed for this reaction included four

series of changes: the spontaneous reaction, base-catalyzed reaction, product-catalyzed reaction and base-product-catalyzed reaction. The kinetics derived from the mechanism are summarized in the following equation:

$$k_e = k_o + k_c[B] + k_c'[P] + k_c''[P][B]$$

The spontaneous reaction is very slow (k_o is approximately 5.4×10^{-7} l. mole⁻¹sec.⁻¹). In the absence of amine the product-catalyzed reaction is also slow (k_e approximately 8×10^{-6} l. mole⁻¹sec.⁻¹). Values for the other rate constants were determined by graphical methods using data from reactions in toluene with triethyl amine as catalyst.

$$k_c, 1.04; k_c', \text{ca. } 10^{-3}; k_c'', \text{ca. } 2.2$$

When the experimental values of k_e were compared with values calculated by the use of these constants, good agreement was noted.

Microfilm \$2.75; Xerox \$7.20. 155 pages.

THE REACTIONS OF AMINOPYRIMIDINES WITH CHLOROFORMATE ESTERS

(L. C. Card No. Mic 60-5359)

Martin Lucius Gluntz, Ph.D.
University of Delaware, 1960

Supervisor: Elizabeth Dyer

Studies have been made of the reactions of unsubstituted and of substituted aminopyrimidines with methyl, ethyl, n-amyl and phenyl chloroformates to produce carbamates. 2-Aminopyrimidine reacted with these chloroformates in both aqueous and benzene solutions, 4-aminopyrimidine reacted only in benzene and 5-aminopyrimidine did not react. The structures of the carbamates from 4-aminopyrimidine and methyl chloroformate and ethyl chloroformate were proved by independent syntheses. There is evidence that the initial product from the action of ethyl chloroformate on 2-aminopyrimidine is 1,2-dihydro-1-carbethoxy-2-iminopyrimidine, which then rearranges to give 2-carbethoxyaminopyrimidine.

The presence of two methyl groups on the ring prevented the acylation reaction, as shown by the inactivity of 4-amino-2,6-dimethylpyrimidine toward the alkyl chloroformates.

5-Aminouracil gave normal carbamate products through reaction of its extranuclear nitrogen atom. In one case, with n-amyl chloroformate, another product was obtained which has been assigned the structure of a carbalkoxy derivative having the substituent on the N-1 ring atom. Uracil gave similar products, having carboalkoxy groups at the 1-position. 6-Aminouracil did not react.

Pharmacological tests have shown that these pyrimidine carbamates do not inhibit the growth of tumors.

Microfilm \$2.75; Xerox \$4.40. 85 pages.

ELECTRONIC SPECTROSCOPY OF N-HETEROCYCLIC MOLECULES: PART I: ELECTRONIC SPECTRA OF THE NITROGEN HETEROCYCLIC ANALOGS OF ANTHRACENE.

PART II: A SEMI-EMPIRICAL METHOD FOR CALCULATING $n \rightarrow \pi^*$ TRANSITION ENERGIES IN NITROGEN HETEROCYCLICS.

[To obtain a copy of this thesis, please write directly to Florida State University.]

Robert Warner Harrell, Sr., Ph.D.
The Florida State University, 1958

PART I

The ultraviolet absorption spectra of acridine and phenazine were studied in several solvents and carefully compared with the absorption spectrum of the parent hydrocarbon, anthracene. While the long wavelength band of this latter molecule exhibits a simple vibrational envelope resulting from a single electronic excitation, the corresponding bands of acridine and phenazine are quite complicated, probably consisting of several electronic transitions.

The absorption spectra revealed that the lowest energy transition in acridine was due to a $\pi \rightarrow \pi^*$ excitation, whereas studies on phenazine showed that the $\pi \rightarrow \pi^*$ transitions of this molecule occurred at higher energies than the lowest $n \rightarrow \pi^*$ excitation. These assignments were supported by the observations that acridine emitted an intense fluorescence while phenazine was non-fluorescent. This is the expected behavior when the (n, π^*) state lies respectively above (in acridine) or below (in phenazine) the lowest (π, π^*) state. In addition, acidified solutions of phenazine containing the phenazinium ion, in which the (n, π^*) and (π, π^*) states are interchanged, exhibited intense fluorescence spectra. In this connection, although phenazine "glasses" are non-fluorescent, a weak emission from the lowest (n, π^*) singlet state was obtained from crystalline phenazine, corresponding to the observed $n \rightarrow \pi^*$ absorption band in solution.

The origin of the long wavelength, charge-induced bands of the acridinium and phenazinium cations was described in terms of molecular orbital theory and from their solvent behavior, identified as $\pi \rightarrow \pi^*$ type transitions. Other studies on acridine and phenazine led to the observation of the $\pi \rightarrow \pi^*$, singlet \rightarrow triplet absorption bands of these molecules and their corresponding singlet \leftarrow triplet phosphorescence emissions. Although the intensity of acridine phosphorescence was too weak to permit a direct lifetime measurement, the intensity of phenazine phosphorescence was sufficiently high and a value of 0.023 sec. was observed for the phosphorescence lifetime in an ether-isopentane glass at 77°K.

The electronic spectra of phenazine N-oxide and phenazine di-N-oxide were studied in order to establish what effects would extending the π -conjugated system have on the spectra of the parent heterocyclic. Also, the effects on the energies of the $n \rightarrow \pi^*$ transitions were noted as the lone-pair electrons were successively bonded to oxygen atoms. In the oxides, the principal $\pi \rightarrow \pi^*$ absorption bands occurred, as expected, at lower energies than in phenazine and both molecules emitted intense fluorescence spectra, indicating that the (π, π^*) singlet

states occurred at lower energies than the possible (n, π^*) lowest singlet states.

PART II

The lowest allowed $n \rightarrow \pi^*$ transition energies have been calculated, employing an adaptation of the semi-empirical L.C.A.O.-M.O. method to the non-bonding nitrogen and π -molecular orbitals of twelve nitrogen heterocyclics. These values are compared with experimental results where available. The necessary spectroscopic resonance integrals are obtained from the corresponding hydrocarbons and are shown to yield satisfactory energies. The value of the coulombic integral for a π -orbital on a nitrogen atom is supported by experimental evidence and the electronegativity parameters for nitrogen lone-pair orbitals are evaluated from experimental $n \rightarrow \pi^*$ energies. These latter values are used in evaluating the n -orbital energies obtained by means of the variation theorem. Orbital overlap integrals, configuration interaction and an explicit accounting for the charge redistribution occurring during the $n \rightarrow \pi^*$ transitions have been neglected in the calculations. This neglect is justified in part by the purpose of these calculations, which was to provide a qualitative guide to the interpretation of the spectra, rather than to aspire to precision calculation of state energies.

146 pages.

REACTIONS OF α, α -DIALKYL- α -MERCAPTOACETAMIDES WITH CARBONYL COMPOUNDS.

(L. C. Card No. Mic 60-5362)

John Cary James, Ph.D.
University of Delaware, 1960

Supervisor: Dr. Glenn S. Skinner

A variety of α, α -dialkyl- α -mercaptoacetamides were obtained from the corresponding 5,5-dialkyl-2-imino-4-thiazolidinones by alkaline hydrolysis. The α, α -dialkyl- α -mercaptoacetamides condensed readily with most carbonyl compounds in the presence of mineral acids to form substituted 4-thiazolidinones, the properties of which depended on the nature and position of the substituents. In general, reactions of the mercapto amides with aliphatic aldehydes led to the formation of high melting dimeric 4-thiazolidinones. When the substituents at position 5 were different, two isomeric 4-thiazolidinone dimers were obtained in approximately 1:1 ratio where formaldehyde was employed as the carbonyl reagent. If the substituents at position 5 were identical, then only one 4-thiazolidinone dimer was obtained from the reaction of the mercapto amide with formaldehyde. Two isomeric 4-thiazolidinone dimers with identical substituents at position 5 were obtained, however, in the reaction of α -ethyl- α -mercapto- n -butyramide with acetaldehyde. In this case the substituents at position 2 were different. A characteristic, single, sharp infrared absorption band of strong intensity in the region of 2.94μ , not present in the spectra of the 2-aryl or the 2,2-disubstituted-4-thiazolidinones, was observed for each of the dimeric 4-thiazolidinones in the solid state.

The bimolecular nature of the compounds was established by molecular weight determinations of each of the dimers. The dimers were easily N-methylated to produce an abrupt change in physical properties, notably a marked lowering of melting points. Methylation of isomeric 4-thiazolidinone dimers gave the same N-methyl derivative, which was monomeric.

When the aldehyde was aromatic, only one compound, which was monomeric, was obtained in high yield from the reaction with an α, α -dialkyl- α -mercaptoacetamide. In all cases the 4-thiazolidinones obtained from the reactions of mercapto amides with ketones were monomeric, as indicated by molecular weight determinations. In no case were two compounds isolated when the 4-thiazolidinone was disubstituted at position 2. A characteristic single infrared absorption band of strong intensity in the region of 3.14μ , somewhat broader than the 2.94μ band mentioned above, was observed for each of the monomeric 4-thiazolidinones in the solid state.

Evidence that the products of the reactions of α, α -dialkyl- α -mercaptoacetamides with carbonyl compounds are cyclic compounds and not Schiff bases was given by the fact that none of the 4-thiazolidinones gave a positive test for the mercapto function with sodium nitroprusside reagent. Also, none of the infrared spectra exhibited a band characteristic of the mercapto group. Evidence of an amide structure was given by the fact that several prominent amide bands were observed in the infrared spectra.

Attempts to extend the reaction to α, α -diphenyl- α -mercaptoacetamide failed due to the inability to isolate the amide from the alkaline hydrolysis of 5,5-diphenyl-2-imino-4-thiazolidinone or from other attempted preparations. Several examples of a new mode of ring cleavage between positions 1 and 5, not previously reported for this ring system, were observed. In general, the carbamyl-diphenylmethyl-sulfur bond and the carboxydiphenylmethyl-sulfur bond were found to be unstable in the presence of strong bases. Typical products of these reactions were diphenylacetic acid, diphenylacetamide, and elemental sulfur.

Benzilamide, the oxygen analog of diphenylmercaptoacetamide, was condensed with formaldehyde, acetaldehyde, and acetone to give three new 4-oxazolidinones which had properties and spectra similar to the 4-thiazolidinones substituted in the same positions.

Microfilm \$2.75; Xerox \$6.00. 121 pages.

THE CHEMISTRY OF 2-BENZHYDRYLPHENYLACETIC ACID AND SOME NEW CONDENSATION REACTIONS IN POLYPHOSPHORIC ACID

(L. C. Card No. Mic 60-6553)

Joel Dexter Jamison, Ph.D.
Northwestern University, 1960

This investigation was initiated to extend our knowledge of systems capable of exhibiting 1,5-aryl migrations. In a previous investigation,¹ it was found that the peri-substituted-naphthalene compound, 8-benzhydryl-1-naphthoyl chloride, rearranged in stannic chloride to a substance

which on hydrolysis gave (>90%) 1-phenylhydroxymethyl-8-benzoylnaphthalene hemiketal. A similar rearrangement took place when 8-benzhydryl-1-naphthoic acid was treated with concentrated sulfuric acid. It was shown that this transformation involved a 1,5-phenyl migration. The ease of interaction between the peri-substituents was rationalized by consideration of the rigidity of the peri-substituted-naphthalene system and the proximity of the peri-substituents.

In order to test the aforementioned rigid geometry as a prerequisite to a 1,5-phenyl migration, the more flexible molecules, 2-benzhydrylphenylacetic acid and 2-benzhydrylphenylacetyl chloride, were synthesized and subjected to a variety of acidic reagents. Although the benzhydryl group and the carboxyl group in 2-benzhydrylphenylacetic acid and its acid chloride may assume a relative position very close to that obtaining in 8-benzhydryl-1-naphthoic acid (or its acid chloride), neither 2-benzhydrylphenylacetic acid nor its acid chloride gave a product that would have resulted from a 1,5-phenyl migration. Instead, a new seven membered ring ketone, 10,11-dihydro-5-phenyl-5H-dibenzo(a,d)cyclohepten-10-one, and the enol-acylate derivative, 10-(2-benzhydrylphenylacetoxy)-5-phenyl-5H-dibenzo(a,d)cycloheptene, were obtained. The reactions leading to these products were slow and gave low yields in comparison with the rearrangement of 8-benzhydryl-1-naphthoic acid and its acid chloride. Therefore, it appears that the structural requirements for a 1,5 migration are very stringent and that any deviation from the rigidity of the peri-substituted-naphthalene geometry can not be tolerated.

In the course of these studies, 2-benzhydrylphenylacetic acid was heated with a mixture of acetic and polyphosphoric acid. From this reaction was isolated (58%) a new substance which was shown to be 4,9-dihydro-2-methyl-9-phenyl-3,4,6,7-dibenzocyclohept(1,2-b)pyran-4-one. A similar reaction using propionic acid instead of acetic acid led to the corresponding 2-ethyl-3-methylpyran-4-one derivative. It was shown that the initial step in this reaction was the cyclodehydration of 2-benzhydrylphenylacetic acid to the aforementioned seven membered ring ketone. The reaction leading to these substances constitutes a new pyran-4-one synthesis.

In order to extend the scope of this new synthesis, deoxybenzoin (an open chain, aryl methylene ketone similar to 10,11-dihydro-5-phenyl-5H-dibenzo(a,d)cyclohepten-10-one) was subjected to similar conditions. However, only a trace (<1%) of a pyran-4-one derivative was obtained; the principal product (15%) was 5-methyl-11H-benzo(a)fluoren-11-one. Propionic acid reacted in a manner similar to acetic acid, affording 5-ethyl-6-methyl-11H-benzo(a)fluoren-11-one. These compounds formed many derivatives, among which were the corresponding fluoren-11-ol and fluorene derivatives. The reaction leading to the fluorenone derivatives constitutes a new synthesis of polynuclear aromatic compounds and, in view of the operational simplicity, offers promise in the synthesis of other polynuclear fluorenones and their alcohol and hydrocarbon derivatives.

Our knowledge of the reactions of ketones with acetic acid in polyphosphoric acid was extended by an investigation of the reaction of 1,3-diphenyl-2-propanone, phenyl-2-propanone, and 3-pentanone. Pyran-4-ones were obtained exclusively, i.e., 1,3-diphenyl-2-propanone afforded (75%) 2,6-dimethyl-3,5-diphenylpyran-4-one;

phenyl-2-propanone afforded (48%) 2,6-dimethyl-3-phenylpyran-4-one; and 3-pentanone gave the known tetramethylpyran-4-one (25%). This reaction provides a general, one step synthesis of 2,6-dimethyl-3,5-aryl or alkyl-substituted-pyran-4-ones from reasonably available ketones.

1. P. T. Lansbury and R. L. Letsinger, J. Am. Chem. Soc., **81**, 940 (1959).

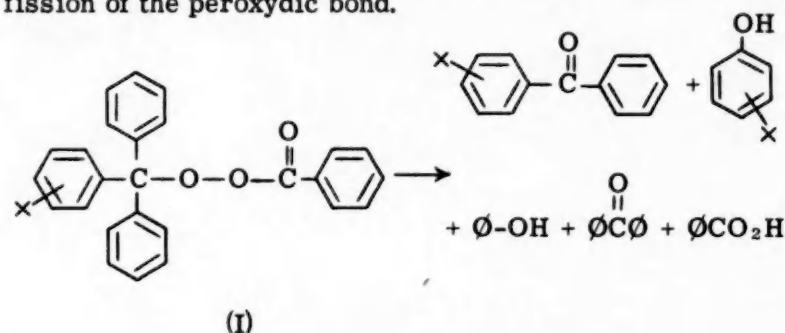
Microfilm \$2.75; Xerox \$7.00. 147 pages.

TIMING OF THE COVALENCY CHANGES IN THE REARRANGEMENT OF TRIARYLMETHYL PERBENZOATES

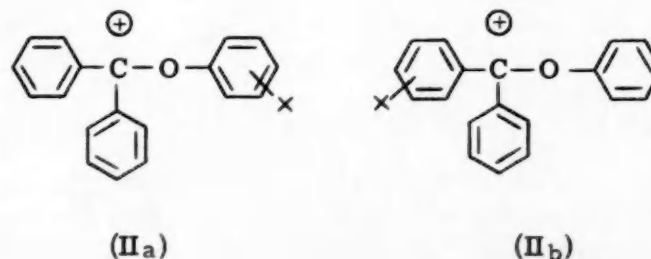
(L. C. Card No. Mic 61-280)

Isaac Jacob Levine, Ph.D.
University of Kansas, 1960

A substituted triphenylmethyl perbenzoate (I) can undergo rearrangement in a polar solvent to yield benzoic acid and both substituted and unsubstituted phenols and benzophenones. The rearrangement occurs with an ionic fission of the peroxydic bond.



It was our aim, in studying this reaction, to determine whether the entire rearrangement occurs in a synchronous manner or whether the ionization and rearrangement steps are discrete ones. Our approach to the problem was to determine the rate of reaction and product composition for each of a series of substituted triphenylmethyl perbenzoates. Because of the failure of *t*-butyl perbenzoate to rearrange under the conditions employed for the rearrangement of the triarylmethyl perbenzoates, it appears that assistance from the neighboring aryl groups is required for the departure of the benzoate anion. This being the case, there still remain two possible mechanisms for the reaction. One is an assisted ionization leading directly to rearranged cations (both Π_a and Π_b). The other possible mechanism is an assisted ionization leading to a phenonium-type ion which is capable of undergoing equilibration with isomeric ions. Since, in the first case, the rate and product-determining steps are identical,



there should exist a quantitative relationship between the total rates of reaction and the product compositions.

Rates were measured for reactions carried out in 80% aqueous acetone by withdrawing aliquots at intervals and titrating the benzoic acid that had been formed. The compositions of the phenol mixtures were determined by gas-liquid phase chromatography, and the benzophenone mixtures were analyzed by infrared spectrophotometry.

No quantitative relationship between rates and product compositions was observed. The total rates of reaction showed a relatively low sensitivity to substituent changes, while the product compositions were highly dependent on the nature of the substituent present in the perester.

Rates were measured at three different temperatures and activation parameters were calculated from these data. In addition, the effect of added lithium perchlorate upon the rate of rearrangement of triphenylmethyl perbenzoate itself was determined.

Microfilm \$2.75; Xerox \$8.20. 177 pages.

THE ACID-CATALYZED CONDENSATION REACTIONS OF REISSERT COMPOUNDS WITH CARBONIUM IONS

(L. C. Card No. Mic 61-281)

Tsung-kai Liao, Ph.D.
University of Kansas, 1960

1. Statement of the Problem. Since the proposal of Cobb and McEwen in 1955 of the mechanism of acid-catalyzed hydrolysis of Reissert compounds, it has been believed that Reissert compounds, in the presence of mineral acids, might exhibit not only electrophilic but also nucleophilic character in condensation reactions, depending upon the nature of the reactants encountered in the acidic media. The objective of the present work has been to investigate the possible dualistic properties of the intermediate formed from the isoquinoline Reissert compound in the presence of sulfuric acid and to generalize, if possible, on the course of the acid-catalyzed condensation reactions of Reissert compounds with various electrophilic agents.

2. Procedures. To a solution of 2-benzoyl-1,2-dihydroisoquinolaldehyde and a potential electrophilic agent in dry dioxane or dioxane-ether was added a proper amount of concentrated sulfuric acid at room temperature with vigorous stirring. The solution was stirred for approximately 20 hours, and isoquinolaldehyde bisulfate which had formed was collected by filtration. The filtrate was diluted with a large amount of water to liberate all organic materials, which were then subjected to further separation procedures and characterization. With aldehydes, no solvent was used, and sulfuric acid was replaced by concentrated hydrochloric acid or hydrogen chloride gas.

3. Findings and Conclusions

a. As a result of the reaction of 2-benzoyl-1,2-dihydroisoquinolaldehyde with the benzhydryl cation, derived from benzhydrol and concentrated sulfuric acid, α,α -diphenylacetophenone was isolated in 75% yield.

b. With 1,1-diphenylethanol or 1,1-diphenylethylene, there were obtained three previously unknown substances, whose structures have been determined on the basis of degradation data to be as follows:

Compound	Structures	M.p.
<u>A</u>	2,2,5-Triphenyl-4-(1-isoquinolyl)-pyrrolenine	194-194.5°
<u>B</u>	2,3,5-Triphenyl-4-(1-isoquinolyl)-pyrrole	262-263.5°
<u>C</u>	2,3,5-Triphenyl-4-(1-isoquinolyl)-pyrrole bisulfate	311-313°

c. When 1-phenyl-1-p-anisylethylene was used in place of 1,1-diphenylethylene, four hitherto unknown compounds were isolated. Their structures have been proposed to be the following, mainly on the basis of analogy with the products of the 1,1-diphenylethylene reaction:

Compound	Structure	M.p.
<u>D</u>	2,5-Diphenyl-2-p-anisyl-4-(1-isoquinolyl)-pyrrolenine	204-206°
<u>E</u>	2-p-Anisyl-3,5-diphenyl-4-(1-isoquinolyl)-pyrrole	212-213°
<u>F</u>	2,5-Diphenyl-3-p-anisyl-4-(1-isoquinolyl)-pyrrole	237-238°
<u>G</u>	2,5-Diphenyl-3-p-anisyl-4-(1-isoquinolyl)-pyrrole	277-281°

d. The reaction of mesitoic acid with the isoquinoline Reissert compound in the presence of concentrated sulfuric acid gave a compound of molecular formula $C_{32}H_{23}N_2O$, m.p. 206-209°; this has not been characterized further.

e. With the triphenylmethyl cation, only triphenylmethane was isolated; this arose as a result of a Bartlett-Condon-Schneider reaction of the carbonium ion with the solvent.

f. In order to find improved methods for preparing potential anti-cancer agents of the type of 2-(1-isoquinolyl)-4,5-diphenyloxazole, both benzaldehyde and p-tolualdehyde were condensed with the isoquinoline Reissert compound under various experimental conditions.

Microfilm \$2.75; Xerox \$5.60. 115 pages.

INVESTIGATIONS IN CYCLOBUTANE CHEMISTRY

(L. C. Card No. Mic 60-4111)

William James Link, Ph.D.
The Ohio State University, 1960

Possible routes for the preparation of stabilized cyclobutadienes from photo-dimers of stilbene, benzalacetophenone, cinnamic acid, and acenaphthylene have been investigated.

Irradiation of trans-stilbene in benzene gave 1, cis-2, trans-3, trans-4-tetraphenylcyclobutane, I, and 1, trans-2, cis-3, trans-4-tetraphenylcyclobutane, II. Reaction of I with N-bromosuccinimide yielded 1,2,3,4-tetraphenyl-1,3-butadiene, III; dimer II was inert to N-bromosuccinimide. Chlorination of I with sulfur chloride yielded 1-chloro-1, cis-2, trans-3, trans-4-tetraphenylcyclobutane, IV; dehydrochlorination of IV gave tetraphenylbutadiene, III. Reaction of I with chlorine gave 1, trans-2-dichloro-1, cis-2, trans-3, cis-4-tetraphenylcyclobutane, V. Dehalogenation of V gave tetraphenylbutadiene, III.

Chlorination of I, II or III gave, following chromatography on activated alumina, 5,10-diphenyl-indeno-(2,1-a)-indene, VI.

Irradiation of benzalacetophenone gave 1, trans-2-dibenzoyl-cis-3, trans-4-diphenylcyclobutane, VII, and 1, trans-3-dibenzoyl-cis-2, trans-4-diphenylcyclobutane, VIII. Chlorination of VII with sulfur chloride yielded 1-chloro-trans-2, cis-3-dibenzoyl-1, trans-4-diphenylcyclobutane, IX. Dehydrochlorination of IX resulted in formation of 1,2-dibenzoyl-3,4-diphenyl-1,3-butadiene, X. Chlorination of VII gave 1, trans-2-dibenzoyl-cis-3, trans-4-dichloro-trans-3, cis-4-diphenylcyclobutane, XI, and an unidentified isomeric dichloride, XII.

Irradiation of acenaphthylene yielded 1,2: cis-3,4-di-1,8-naphthylenecyclobutane, XIII and 1,2: trans-3,4-di-1,8-naphthylenecyclobutane, XIV. Dehydrogenation of XIII and XIV formed diacenaphtho-(1,2-b, 1',2'-d)-thiophene, XV. Chlorination of XIII with sulfur chloride gave 1-chloro-1,2: trans-3,4-di-1,8-naphthylenecyclobutane, XVI.

Irradiation of suspensions of trans-cinnamic acid, rapidly precipitated from cold (0-5°) solutions, gave trans-3, trans-4-diphenyl-1, cis-2-cyclobutanedicarboxylic acid, XVII. Failure to keep the temperature of precipitation low results in the eventual formation of trans-2, cis-4-diphenyl-1, trans-3-cyclobutanedicarboxylic acid, XVIII. Chlorination of the dimethyl ester of XVIII gave an unidentified trichloro derivative, and chloromethyl methyl trans-2, cis-4-diphenyl-1, trans-3-cyclobutanedicarboxylate, XIX. Reaction of lead tetraacetate with XVII gave 1,4-diphenyl-1,3-butadiene, XX.

Microfilm \$2.75; Xerox \$6.40. 133 pages.

NUCLEOPHILIC ADDITION TO OLEFINS

(L. C. Card No. Mic 60-6083)

Bruce Ian Mac Gowan, Ph.D.
University of Oregon, 1961

Adviser: Norman M. van Gulick

Besides conjugate or Michael addition, which owes its success to a sufficiently resonance stabilized carbanion intermediate, are a few polymerization reactions as well as a handful of single reactions in which nucleophilic addition occur to an isolated olefinic double bond. In these cases only the grosser features of the reaction have been observed and a detailed mechanistic study has not been made.

It was previously observed that 2,2-dimethyl-4-pentenamide cyclized to 3,3,5-trimethyl-2-pyrrolidone

when treated with sodium hydride or sodamide and refluxed in a hydrocarbon solvent. This indicated a mild, facile nucleophilic addition to an isolated olefin and served as an ideal model to study the intimate details of the reaction. It was thought that the addition by this weak base was promoted both by the favorable entropy of a cyclization reaction and by the conformation-controlling geminal substitution. It was originally reasoned that this conformational effect could be enhanced by the bulkier geminal phenyl substitution. For this reason 2,2-diphenyl-4-pentenamide and the corresponding N-methyl amide, acid and amine, were synthesized so that a study using conjugate bases of varying strength could be studied. These compounds did not cyclize, however, on treatment with sodium hydride and refluxing xylene. Instead, they were cleaved to 4,4-diphenyl-1-butene. This was proved by synthesis of the latter compound by an unequivocal method and by comparing the derivatives and infra-red spectra. The preference for cleavage over cyclization can be explained by the mesomeric stability obtained by the carbanion from the adjacent geminally substituted phenyl groups. This stability can be shown from the pK_a values of methane and diphenyl-methane to compensate for the gain in energy in the cyclization reaction.

Several mechanistic pathways can be devised to account for the cyclization of N-sodio-2,2-dimethyl-4-pentenamide. One such process is a concerted intramolecular addition wherein the attacking base also serves as the proton donor. Another scheme might involve an external proton donor by a cis or trans concerted intermolecular process. This scheme, in contrast to the first pathway, allows N-sodio-N,2,2-trimethyl-4-pentenamide to cyclize. A third possible scheme is a stepwise intramolecular process involving an internal proton donor. Another variation of the stepwise mechanism would involve an equilibrium, followed by an intermolecular reaction with amide anion as external proton donor to form a pyrrolidone and a doubly charged amide anion which would undergo a fast equilibration to products. This scheme, like the stepwise intramolecular process, would predict that N-substituted amides would not undergo cyclization. This latter situation, however, would obtain in another variation of the stepwise intermolecular scheme which involves a fast equilibrium followed by a reaction with starting amide as external proton donor, but which would not require a doubly charged amide anion. The concerted intermolecular mechanism would imply second order kinetics but the concerted intramolecular and stepwise processes would result in first order kinetics.

The kinetics were followed by measuring the loss of olefinic unsaturation with iodine monobromide followed by back titration with thiosulfate. Good first order kinetics were obtained which eliminated the concerted intermolecular mechanism for 2,2-dimethyl-4-pentenamide only.

Excess sodium hydride did not affect the rate which showed it was not a catalyst for the reaction. From the rates at various temperatures, the cyclization of 2,2-dimethyl-4-pentenamide was found to have an activation energy and entropy of 15.0 ± 1.6 kcal./mole and -33.5 ± 4.2 entropy units respectively. In a similar manner, 2,2-diethyl-4-pentenamide 2,2-diethyl-4-pentenamide gave 31.6 ± 1.0 kcal./mole and -33.8 ± 7.4 entropy units.

N-Sodio-N,2,2-trimethyl-4-pentenamide was found to cyclize only if free amide as proton donor was available which indicated that the last variation of the stepwise

intermolecular mechanism was valid in this case to the exclusion of the other schemes. N-Sodio,2,2-dimethyl-4-pentenamide presumably followed the same mechanism but the other pseudo-first order processes cannot be eliminated. The fact that the corresponding amine and alcohol did not undergo cyclization under similar conditions indicated that the reaction was not general.

Microfilm \$2.75; Xerox \$5.40. 110 pages.

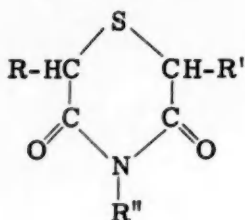
2,6-DISUBSTITUTED-3,5-THIOMORPHOLINEDIONES AND RELATED COMPOUNDS.

(L. C. Card No. Mic 60-5363)

Richard N. Macnair, Ph.D.
University of Delaware, 1960

Supervisor: Glenn S. Skinner

A series of nine new 2,6-disubstituted-3,5-thiomorpholinediones (Type A) has been prepared for the purpose of discovering pharmacologically active compounds, in particular, anticonvulsants. The preparative steps involved in this synthesis are as follows where the product of one step is used in the next step:

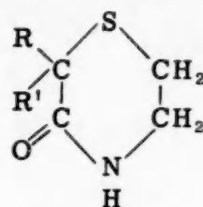


Type A

1. Substituted acetic acids.
2. Substituted acetyl chlorides.
3. Substituted bromoacetyl bromides.
4. Substituted 2-imino-4-thiazolidinones.
5. Substituted mercaptoacetic acids.
6. Substituted thiodiacetic acids.
7. 2,6-Disubstituted-3,5-thiomorpholinediones.

The thiodiacetic acid from step 6 were separated into racemic forms by fractional precipitation and recrystallization and characterized by melting point, analysis and infrared spectra. The thiomorpholinediones from step 7 were prepared with two exceptions by ring closure of thiodiacetic acids and were characterized by melting point, analysis and infrared spectra. The two exceptions were N-methyl derivatives which were prepared by methylation of the corresponding thiomorpholinedione ring. These were liquids but otherwise were characterized in the same manner as the unmethylated compounds. Two of the other seven thiomorpholinediones appeared to have more than one form. These forms were separated by fractional crystallization and distillation and were characterized by melting point or boiling point, analysis and infrared spectra. One form which can be considered representative of them all was found to be optically inactive, as expected.

In addition to these nine compounds, two related compounds were prepared by the following consecutive steps: 1, 2, 3, 4, 8, 9 and 10. The first four steps are identical to those outlined above while the other three appear as follows. These compounds were members of the 2,2-dialkyl-3-thiomorpholone series, (Type B).



Type B

8. α,α -Dialkylmercaptoacetic acids and amides.
9. Dialkyl(2-aminoethylmercapto)acetic acids and amides.
10. 2,2-Dialkyl-3-thiomorpholones.

The mercaptoacetic acids and amide obtained in step 8 were initially isolated as mixtures but were easily separated with bicarbonate and purified by distillation. The dialkyl(2-aminoethylmercapto)acetic acids from step 9 were purified by recrystallization and characterized by melting point, analysis and infrared spectra. Only one dialkyl(2-aminoethylmercapto)acetamide was prepared (step 9). This compound was a deliquescent solid and was not examined further. Ring closure of these acids and the amide produced the two 3-thiomorpholones which were characterized by boiling point or melting point, and infrared spectra. Analyses were not obtained since these two compounds were not new. However, each was prepared by a previously unreported route and one was prepared by two independent routes.

In the present series of 2,6-disubstituted-3,5-thiomorpholinediones, the groups substituted at the 2,6-positions were identical to those substituted geminally in several compounds which are known to possess anticonvulsant activity. However, none of the compounds in the present series which were subjected to preliminary pharmacological screening showed any promise of anticonvulsant activity. Thus it appears that the same groups are less effective in the 2,6-positions than they are in the 2,2-position. Microfilm \$2.75; Xerox \$5.40. 106 pages.

THE HYDROLYSIS OF CYCLOPROPYL ACETATE

(L. C. Card No. Mic 61-455)

Lee Robert Mahoney, Ph.D.
Iowa State University of Science and Technology, 1960

Supervisor: Charles H. DePuy

Cyclopropyl alcohol has been prepared for the first time in the pure state. The synthesis was the result of a kinetic investigation of the series of reactions, catalyzed by base, leading from cyclopropyl acetate to 2-methyl-2-penten-1-al.

The first rate determined was that of the saponification of cyclopropyl acetate. Since the reaction was very rapid a conductrimetric method was employed to obtain reliable rate data.

Since propionaldehyde, identified as one of the intermediates in the series of reactions undergoes aldol condensation in basic solution, the rate of formation of 2-methyl-2-penten-1-al was then followed by an ultra-violet spectrophotometric technique. It was found that the rate of formation of this product was from 100-200 times higher from a given concentration of propionaldehyde than from an equal concentration of cyclopropyl acetate and base.

Since the acetate is essentially completely hydrolyzed a short period of time after mixing with base, relatively slow reaction must take place prior to the formation of propionaldehyde and subsequent to the hydrolysis of cyclopropyl acetate.

As a result of these findings a synthesis of the alcohol by addition of lithium aluminum hydride to cyclopropyl acetate was attempted and proved successful. A 55% yield of the pure alcohol was obtained by means of a gas phase chromatographic isolation of the material. The identity of the alcohol was confirmed by its satisfactory analysis, its thermal isomerization to propionaldehyde, preparation of derivatives which had the same melting points as those reported by previous investigators and by its spectral properties.

It was then demonstrated that cyclopropyl alcohol is relatively long lived in basic solution, since the rate of formation of 2-methyl-2-penten-1-al from cyclopropyl alcohol was identical to the rate observed from cyclopropyl acetate at the same concentration. A preliminary investigation of the thermal isomerization of cyclopropyl alcohol to propionaldehyde in a series of solvents was also made.

In conjunction with the above a kinetic study of the saponification of a number of enol acetates at various temperatures was made. The results indicate that the mechanism of basic hydrolysis of enol acetate is of the same type as that observed in the series of saturated alkyl acetates.

Microfilm \$2.75; Xerox \$4.40. 84 pages.

OZONOLYSES OF PHENANTHRENE AND UNSYMMETRICAL OLEFINS

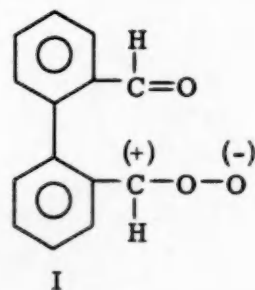
(L. C. Card No. Mic 60-6650)

Sashikant Bhanji Mainthia, Ph.D.
The University of Texas, 1959

Supervisor: Philip S. Bailey

The first portion of this dissertation is a continuation of the study of the ozonolyses of phenanthrene, initiated by Bailey (J. Am. Chem. Soc., 78, 3811 (1956), in various inert and reactive solvents with the view of determining whether or not the Criegee mechanism for ozonolysis of carbon-carbon multiple bonds carries over to the aromatic field.

Phenanthrene reacted with one mole of ozone at the reactive 9,10 bond. In inert solvents (chloroform, carbon tetrachloride, 1,2-dichloroethane and methyl chloride), the zwitterion intermediate (I) polymerized to a polymeric ozonide, the structure of which has been elucidated. Cryoscopic molecular weight determination in various solvents showed the polymeric ozonide to at least a monomer. The



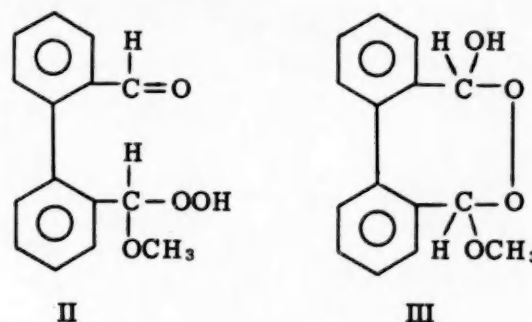
I

polymeric ozonide decomposed and/or depolymerized rapidly in several solvents. This had led to an earlier erroneous assignment of a monomeric ozonide structure to the substance by other authors (Schmitt, W. J., Moriconi, E. J., and O'Connor, W. F., J. Am. Chem. Soc., 77, 5640 (1955).

The polymeric ozonide was reduced to 2,2'-biphenyldicarboxaldehyde with sodium iodide and was oxidized to diphenic acid by a formic acid-hydrogen peroxide mixture. It slowly decomposed, on standing, to a mixture of 2-2'-biphenyldicarboxaldehyde, 2-formyl-2'-biphenylcarboxylic acid, diphenic acid and a small amount of phenolic material.

The ozonolysis of phenanthrene in acetic acid gave a mixture of the polymeric ozonide and an acetoxyhydroperoxide. Oxidation and decomposition of this material gave results similar to those obtained in the case of the polymeric ozonide.

The first isolable product from the ozonolysis of phenanthrene in methanol has been obtained in purified form. This has been shown to have a cyclic structure (III), rather than the open chain hydroperoxide structure (II), previously assigned by Bailey. In solution with chloroform and bromoform, tautomerization to II and/or decomposition occurred. Addition of a few drops of hydrochloric acid to the methanolic ozonolysis mixture (or to a solution of III in methanol) resulted in the immediate precipitation of the dimethoxy analog of III.



II

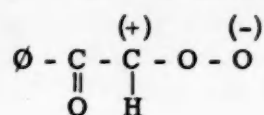
III

Thus this work and earlier work by Bailey indicates that the Criegee mechanism carries over to the aromatics field.

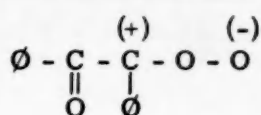
The second portion of the dissertation is concerned with the study of the specificity of ozone attack with certain unsymmetrical dibenzoyl ethylene derivatives (for earlier examples of this specificity, see Bailey, P. S., and Bath, S. S., J. Am. Chem. Soc., 79, 3120 (1956).

These materials were ozonized in the presence of methanol. The major products of ozonolysis of *cis*-1,2-dibenzoylpropene were α -hydroperoxy- α -methoxypropio-phenone and phenylglyoxal, just as in the case of the *trans* isomer. The major products in the case of *cis*-1,2-dibenzoyl-1-methoxyethylene were α -hydroperoxy- α -methoxyacetophenone and methyl phenylglyoxalate. In the case of *cis*-1-amino-1,2-dibenzoyl ethylene and *cis*-1,2-dibenzoylstyrene, no peroxidic products could be isolated. The course of the reactions, however, were clearly indicated by the isolation in high yields of the decomposition products benzoic acid (from zwitterion IV) and phenylglyoxamide from *cis*-1-amino-1,2-dibenzoyl ethylene and benzoic acid and benzoic anhydride (from zwitterion V), and phenylglyoxal from *cis*-1,2-dibenzoylstyrene.

A mechanism involving the initial formation of a complex between the π electrons of the carbon-carbon double bond or an aromatic molecule and the electrophilic terminal



IV



V

oxygen atom of the ozone molecule appear best to account for these and other results. Alternative mechanisms have also been suggested.

Several halogen-substituted olefins also have been ozonized. It was found that halogen groups greatly deactivate the double bond toward reaction with ozone.

Microfilm \$2.75; Xerox \$8.00. 174 pages.

THE REACTION OF N, N-DISUBSTITUTED AMIDES WITH PHENYL ISOCYANATE.

(L. C. Card No. Mic 60-5375)

Theodore Eugene Majewski, Ph.D.
University of Delaware, 1960

Supervisor: Elizabeth Dyer

The reactions of phenyl isocyanate with N, N-dimethyl formamide, with N, N-diethyl formamide and with N, N-dimethyl acetamide have been studied in detail.

From the reaction of phenyl isocyanate and N, N-dimethyl formamide, triphenyl isocyanurate, N, N-dimethyl-N'-phenyl urea, N-phenyl-N', N'-dimethyl formamidine and a new compound, $\text{C}_{28}\text{H}_{20}\text{N}_4\text{O}_3$, have been isolated.

N, N-Diethyl formamide and phenyl isocyanate reacted to form triphenyl isocyanurate, N, N-diethyl-N'-phenyl urea, N-phenyl-N', N'-diethyl formamidine and the same new compound, $\text{C}_{28}\text{H}_{20}\text{N}_4\text{O}_3$.

The new trisubstituted formamidines have been synthesized independently.

When each of the trisubstituted formamidines was treated with phenyl isocyanate, the compound $\text{C}_{28}\text{H}_{20}\text{N}_4\text{O}_3$ was the main product. The corresponding N, N-alkyl-N' phenyl ureas were also isolated.

From the reaction of phenyl isocyanate with N, N-dimethyl acetamide, the products were triphenyl isocyanurate, 1, 3, 5 triphenyl biuret, sym-diphenyl urea, and three new unidentified compounds. Of these, a compound of formula $\text{C}_{25}\text{H}_{22}\text{N}_4\text{O}_3$ was found in the greatest yield and efforts were made to identify it. Evidence for a probable structure is given.

1, 3-Diphenyl-5-(phenyl carbamyl) - barbituric acid was obtained by acid hydrolysis of the compound of formula $\text{C}_{25}\text{H}_{22}\text{N}_4\text{O}_3$. This new barbituric acid derivative was also synthesized from reaction of the sodium salt of 1, 3-diphenyl barbituric acid with phenyl isocyanate and from the reaction of 1, 3-diphenyl barbituric acid with N, N-dimethyl-N'-phenyl urea at 180° .

Microfilm \$2.75; Xerox \$4.40. 82 pages.

THE CHEMISTRY OF SOME β -SUBSTITUTED- γ -BUTYROLACTONES AND β -SUBSTITUTED- α -OXO- γ -BUTYROLACTONES

(L. C. Card No. Mic 60-3294)

Monis Joseph Manning, Ph.D.
University of Cincinnati, 1960

Supervisor: Dr. Hans Zimmer

The Meerwein-Ponndorf reduction of β -veratroyl- γ -butyrolactone gave both the alcohol β -(α -hydroxy-veratryl)- γ -butyrolactone and significant amounts of β -veratrylidene- γ -butyrolactone. The latter lactone was obtained on a preparative scale by acid-catalyzed dehydration of the alcohol. It failed to condense with veratraldehyde at the α -position. Catalytic hydrogenation of β -veratrylidene- γ -butyrolactone yielded β -veratryl- γ -butyrolactone which has also been obtained by direct hydrogenation of β -veratroyl- γ -butyrolactone with palladium chloride (Rothe & Zimmer, *J. Org. Chem.*, **24**, 586 (1959)).

The chemistry of α -oxo- β -benzoyl- γ -butyrolactone was investigated. The β -benzoyl group could be reduced selectively by hydrogenation with palladium chloride as catalyst yielding α -hydroxy- β -benzyl- $\Delta^{\alpha,\beta}$ - γ -butyrolactone. This lactone reacted with diazomethane giving α -methoxy- β -benzyl- $\Delta^{\alpha,\beta}$ - γ -butyrolactone.

α -Oxo- β -benzoyl- γ -butyrolactone existed as an enolized β -diketone even in the solid state. This lactone reacted rapidly with diazomethane yielding α -methoxy- β -benzoyl- $\Delta^{\alpha,\beta}$ - γ -butyrolactone, which did not react with o-phenylenediamine. This indicated that the enolic site had been at the α -position in the original lactone. Verification of this structure was made by selective reduction of the β -benzoyl group by hydrogenation with palladium chloride as catalyst yielding α -methoxy- β -benzyl- $\Delta^{\alpha,\beta}$ - γ -butyrolactone which was identical with the enol methyl ether obtained from the reduction route above. Thus the correct enol form of α -oxo- β -benzoyl- γ -butyrolactone was α -hydroxy- β -benzoyl- $\Delta^{\alpha,\beta}$ - γ -butyrolactone.

In contrast to the enolic character of α -oxo- β -benzoyl- γ -butyrolactone in the solid state, α -oxo- β -veratroyl- γ -butyrolactone showed no enolic OH-absorption band in its solid state IR-spectrum. Consequently this lactone reacted very slowly with diazomethane to form α -methoxy- β -veratroyl- $\Delta^{\alpha,\beta}$ - γ -butyrolactone.

The UV-spectra of these α -ketolactones and their corresponding enol methyl ethers in very dilute (10^{-4} Molar) methanol solution were nearly identical. This showed that in dilute solution the α -ketolactones were in the same enolic form from which their enol ethers were derived.

The UV-spectra of α -hydroxy- β -benzoyl- $\Delta^{\alpha,\beta}$ - γ -butyrolactone exhibited the presence of an additional weak absorption band at $348 \text{ m}\mu$. When the dissociation of the enol was suppressed with a trace of acid this absorption band disappeared. The spectrum of the completely dissociated enolate anion revealed the presence of a very intense band at the same wave length.

The UV-spectra of α -oxo- β -veratroyl- γ -butyrolactone both in neutral and acidified methanol were nearly identical with the spectrum of the enol methyl ether, α -methoxy- β -veratroyl- $\Delta^{\alpha,\beta}$ - γ -butyrolactone. This indicated that though this α -ketolactone existed as an enol in solution,

it was essentially undissociated and hence the enolic form was a very weak acid.

Meerwein-Ponndorf reduction of α -oxo- β -benzoyl- γ -butyrolactone led to formation of α -oxo- β -benzylidene- γ -butyrolactone. The preparation of this compound represented an exception to the usual non-reducibility of β -diketones with aluminum alkoxides. Selective chelate formation of the starting lactone with aluminum isopropylate was suggested as an explanation. Similarly, α -oxo- β -veratrylidene- γ -butyrolactone was prepared from α -oxo- β -veratroyl- γ -butyrolactone.

Characterization of α -hydroxy- β -benzyl- $\Delta^{\alpha,\beta}$ - γ -butyrolactone and α -oxo- β -benzylidene- γ -butyrolactone by condensation of the two adjacent carbonyl groups with *o*-phenylenediamine led to aminolysis of the lactone ring forming 3-[(β -hydroxymethyl)phenethyl]-2-quinoxalinone and 3-[(β -hydroxymethyl)styryl]-2-quinoxalinone, respectively. In contrast to this behavior, α -hydroxy- β -benzoyl- $\Delta^{\alpha,\beta}$ - γ -butyrolactone did not undergo scission of the lactone ring during reaction with *o*-phenylenediamine, but formed instead 2,3-dihydro-3-benzoylfuro (2,3-b)-quinoxaline whose tautomeric forms can be stabilized by resonance and thus offered an explanation for its formation.

The reaction of α -oxo- β -benzylidene- γ -butyrolactone with benzyl Grignard reagent resulted in 1,4-addition of the organometallic reagent to the α,β -unsaturated ketone system of the lactone yielding α -hydroxy- β -dibenzyl- $\Delta^{\alpha,\beta}$ - γ -butyrolactone ($C_{18}H_{18}O_3$). Characterizing derivatives were not readily prepared, but when the enol lactone was heated with phosphoric acid, dehydration occurred yielding a lactone $C_{18}H_{14}O_2$. This lactone could be hydrogenated to $C_{18}H_{16}O_2$ or $C_{18}H_{22}O_2$, depending on conditions employed, but none of these lactones were definitely characterized.

Microfilm \$2.75; Xerox \$6.00. 122 pages.

RELATIVE RATES OF ADDITION AND REDUCTION IN THE GRIGNARD REACTION

(L. C. Card No. Mic 60-6743)

John Arthur Miller, Ph.D.
Stanford University, 1960

An investigation was made of the relative rates of addition and reduction in the reactions of Grignard reagents with ketones. Dilute solutions of Grignard reagents were mixed with dilute solutions of ketones in an efficient mixing device under controlled conditions and the product mixtures were analyzed by gas partition chromatography.

The ratio of addition product to reduction product in the reaction between 3-methyl-2-butanone and the Grignard reagent from 2-bromopropane was found to be dependent only upon the ratio of the concentration of the reactants. The same result was obtained from the reaction between 2,4-dimethyl-3-pentanone and the Grignard reagent from ethyl bromide. The data from this latter reaction indicated that the reaction proceeded with consecutive, bimolecular kinetics. This was taken as evidence that the Grignard reagent from ethyl bromide was a dimer in the concentration range 0.05 to 0.5 normal.

On the basis of a dimeric Grignard reagent, possible

mechanisms for the addition, reduction and enolization reactions of Grignard reagents with ketones were discussed.

Microfilm \$2.75; Xerox \$5.60. 112 pages.

THE PROTON NUCLEAR MAGNETIC RESONANCE SPECTRA OF CYCLOHEXANE, CIS- AND TRANS-DECALIN, CIS- AND TRANS-HYDRINDAN, AND CIS-BICYCLO(3.3.0)OCTANE.

(L. C. Card No. Mic 61-54)

William Bettencourt Moniz, Ph.D.
The Pennsylvania State University, 1960

A study has been made of the temperature dependence of the 40 mc. proton nmr spectra of cyclohexane, *cis*- and *trans*-decalin, *cis*- and *trans*-hydrindan, and *cis*-bicyclo(3.3.0)octane.

The cyclohexane spectrum, which consists of a single, sharp signal at normal temperature due to motional averaging, broadens rapidly at temperatures below -60° , becoming an unsymmetrical doublet at $-71.0 \pm 0.5^\circ$, and an unsymmetrical quartet at $-77.5 \pm 0.5^\circ$. The initial appearance of structure in the spectrum indicates that the molecule is undergoing chair-chair interconversion at a rate slow enough that the signals from axial and equatorial protons are distinct; the additional structure is believed to be due to spin coupling between axial and equatorial protons on the same carbon atom.

Approximating the low temperature cyclohexane spectrum as a superposition of six AB systems, a chemical shift of 17.6 c./s. between axial and equatorial protons, and a coupling constant of 8.3 c./s. between axial and equatorial protons on the same carbon atom are calculated.

The asymmetry of the spectrum is explained by noting that coupling between axial protons is much larger than coupling between protons in other conformations. Consistent with this, the high-field component of the doublet, which is assigned to the axial protons, is broadened appreciably more than the low-field component.

Having two spectral parameters and two temperatures, it is possible to calculate an energy barrier (ΔE_\ddagger) to chair-chair interconversion of cyclohexane of 9.3 kcal./mole.

The spectrum of *cis*-decalin remains a singlet at temperatures as low as -121° . Chair-chair interconversions of this molecule apparently involve an energy barrier appreciably lower than that of cyclohexane. It is concluded that the repulsions arising from non-bonded interactions distort the molecule toward a more planar conformation, thus raising the energy of the ground state, and lowering the barrier to chair-chair interconversions.

The spectrum of *cis*-hydrindan consists of two overlapping, relatively sharp signals; the higher-field component is attributed to the protons of the six-membered ring. At temperatures below -110° , the higher-field component broadens rapidly, coalescing with the lower-field component at -127° to produce a broad, single signal. It is apparent that the rate of chair-chair interconversion is approaching the frequency separation of the protons of the six-membered ring. If the four-parameter equation used for the determination of the cyclohexane energy

barrier is employed, assuming that only the two temperatures are different, a value of $\Delta E_{\ddagger} = 4.3$ kcal./mole is obtained for *cis*-hydrindan. Making reasonable assumptions and employing the Eyring equation, a maximum value for the energy barrier of 6.4 kcal./mole is obtained. It is likely that the actual activation energy lies between the two values. Apparently, the barrier to interconversion of *cis*-hydrindan is lower than that of cyclohexane because of the strain introduced in the former by fusion of the five-membered ring.

The broad, diffuse spectra of *trans*-decalin and *trans*-hydrindan resemble the low temperature spectrum of cyclohexane. The nature of the *trans*-fusion does not allow chair-chair interconversions of these molecules. Thus, an assignment of the low-field components to equatorial protons and the high-field components to axial protons is reasonable. At temperatures below -115° , the high-field portion of the *trans*-decalin spectrum begins to broaden; the spectrum of *trans*-hydrindan changes little with temperature.

The characteristic difference between the spectra of the *trans*- and *cis*-fused decalins and hydrindans is of analytical value. It appears that the spectra of compounds containing a *trans*-fused cyclohexane ring will consist of broad, overlapping signals, while systems containing the cyclohexane ring in a *cis*-fusion will show sharp, narrow resonances, if rigidity is not forced upon the molecule by other factors.

The spectrum of *cis*-bicyclo(3.3.0)octane contains a low intensity signal, attributed to the bridgehead protons, approximately 40 c./s. down-field from the main absorptions. Anisotropy calculations account for half of the shift. It appears that non-bonded interactions and ring-fusion strains distort the molecule, causing the bridgehead protons to absorb at lower fields than calculated. The fact that the high-field portion of the spectrum contains resolved components argues for a rigid ring system. It is probable that only β -methylene groups enter appreciably into the puckering motions of the rings.

Microfilm \$2.75; Xerox \$3.60. 64 pages.

THE NUCLEAR MAGNETIC RESONANCE STUDIES OF SOME NATURAL PRODUCTS

(L. C. Card No. Mic 61-55)

Ralph Orris Mumma, Ph.D.

The Pennsylvania State University, 1960

The nuclear magnetic resonance spectra of thirty-four different pentacyclic triterpenoidal derivatives and ten coumarin and furocoumarin derivatives have been studied using a 40 Mc. nuclear magnetic spectrometer.

The triterpenes used for this study mainly belonged to the oleanane, ursane, and lupane class and were used in twenty milligram quantities. Tetrachloroethylene was used as the solvent with an internal standard of chloroform (10%). A number of correlations were made between the structures of the triterpenes and their respective spectra. The important correlations are summarized as follows:

1. Vinylic protons: three types are easily distinguishable.

- a. Normal trisubstituted double bonds (70 to 93 c.p.s.).
- b. Trisubstituted double bonds conjugated with a keto group (60 to 75 c.p.s.).
- c. Terminal double bonds (95 to 118 c.p.s.) with the intensity of two protons. The triterpenes of the lupane class can easily be recognized by this means.

2. Vinylic methyl: clearly distinguishable having an absorption at 218 to 230 c.p.s. A triterpene belonging to the lupane class can also be recognized by this feature.

3. Protons alpha to a secondary acetoxy group have characteristic absorptions depending upon their location and conformation. In certain cases the conformation of the hydroxyl group may be determined.

4. The alpha protons of an acetylated 1,2 glycol have characteristic chemical shifts and can easily be identified.

5. The presence of a primary alcohol can be identified by the absorption of the methylene hydrogens of the acetylated hydroxymethyl function. Not only can the presence of the hydroxymethyl function be shown but the location of such a group can usually be established.

6. Acetates and methyl esters give sharp characteristic absorptions.

7. The presence of a carbomethoxy group at C-28 can be detected in two ways, namely, by the methyl absorption of the methyl ester, and by the high chemical shift of the tertiary methyl absorptions.

In triterpene chemistry it is of primary interest to identify the oxidized function, locate its position, and determine its conformation. The nuclear magnetic resonance spectra of triterpenes, therefore, will aid tremendously in the elucidation of unknown structures.

The nuclear magnetic resonance spectra of coumarins and furocoumarins gave characteristic chemical shifts for the various types of protons. Nuclear magnetic resonance proved to be a very powerful tool in the identification and characterization of such molecules. Samples were used in twenty milligram quantities. Deuteriochloroform was used as the solvent and chloroform (5%) as the internal standard. The C-3 proton of the coumarins and furocoumarins has an absorption of about 38 c.p.s. and the C-4 proton absorbs from -9 to -35 c.p.s. The chemical shift of the protons may vary with the type of molecules being studied. The coupling constants between the C-3 and C-4 protons ($J_{\alpha\beta} = 9.7$ c.p.s.) do not vary much and are very characteristic of this group. The furan type protons of the furocoumarins (C-4' and C-5') have also characteristic absorptions and coupling constants. The C-4' protons have an average absorption of 9 c.p.s., and the C-5' protons of -14 c.p.s. The coupling constants ($J_{\alpha\beta}$) of the protons at C-4' and C-5' have a value of 2.35 c.p.s. The characteristic absorptions and coupling constants will help in the identification and elucidation of unknown structures.

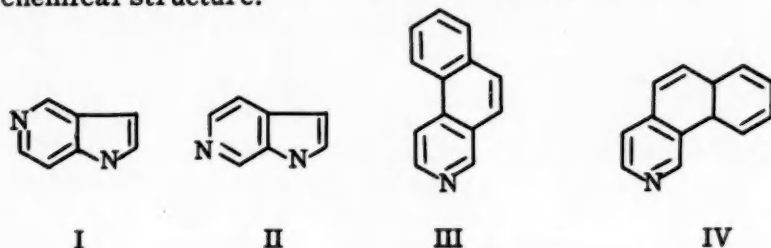
Microfilm \$2.75; Xerox \$6.00. 123 pages.

SYNTHETIC APPROACHES TO
5- AND 6-AZAINDOLES
AND 5,6- AND 7,8-BENZISOQUINOLINES.

(L. C. Card No. Mic 60-3314)

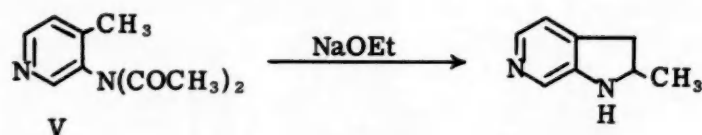
Dasika R. K. Murty, Ph.D.
The Florida State University, 1960

The synthesis of 5- and 6-azaindoles (I and II) and 5,6- and 7,8-benzisoquinolines (III and IV) was undertaken with the hope that the compounds derived from these ring systems might eventually lead to a better understanding of the relationship between physiological properties and chemical structure.

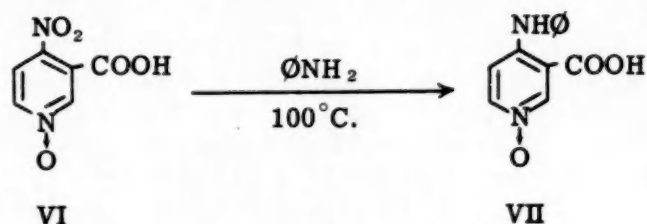


Several approaches leading to the synthesis of 5- and 6-azaindoles were studied. Even though these studies failed to produce the desired ring systems many interesting results were obtained.

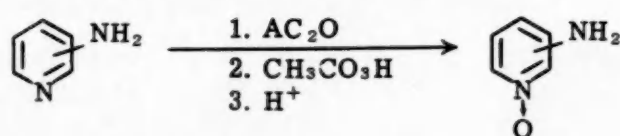
The Madelung cyclization of 4-formamido-3-picoline and 3-formamido-4-picoline, studied under various experimental conditions, led to the formation of the corresponding decarbonylation products. It was found that the salts of the above formamido derivatives were thermally not stable enough to permit cyclization to take place. At least in one case (N,N-diacetyl-3-amino-4-picoline) (V) where salt formation has no chance, cyclization was found to be the predominant reaction.



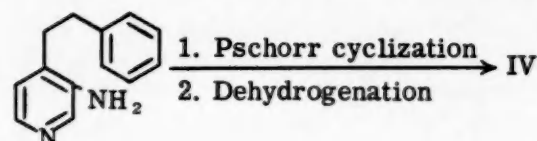
4-Nitro-3-carboxypyridine-1-oxide (VI) was found to undergo a novel nucleophilic displacement reaction with aniline giving rise to 4-anilino-3-carboxypyridine-1-oxide (VII), whose structure was proved by the unequivocal synthesis of its reduction product, 4-anilino-3-pyridine-carboxylic acid.



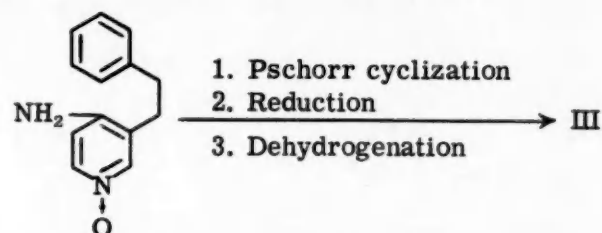
A general method for the conversion of aminopyridines to the corresponding N-oxides was devised and successfully applied to the preparation of 3-aminopyridine-1-oxide and 4-amino-3-(β-phenethyl)pyridine-1-oxide.



A general method involving the application of Pschorr reaction was devised for the synthesis of benzisoquinolines. Cyclization of 3-amino-4-(β-phenethyl)pyridine (VIII) and subsequent dehydrogenation yielded 7,8-benzisoquinoline (IV).



Attempted diazotization of 4-amino-3-(β-phenethyl)pyridine led to the formation of the 4-hydroxy derivatives. However, a stable diazonium salt solution could be obtained from the corresponding pyridine-N-oxide (IX). Pschorr cyclization of this diazonium solution eventually led to the synthesis of 5,6-benzisoquinoline (III).



Some preliminary investigations were made on other synthetic approaches to the benzisoquinoline ring system.

Microfilm \$2.75; Xerox \$4.80. 93 pages.

REACTIONS OF CARBOHYDRATE
C-NITROALDITOLS AND OF
CARBOHYDRATE C-NITROOLEFINS

(L. C. Card No. Mic 60-6767)

Marvin Loren Oftedahl, Ph.D.
Washington University, 1960

Chairman: John C. Sowden

The first part of the dissertation is concerned with the anhydridization of 1-nitro-1-deoxy-hexitols. Three methods are described for the conversion of 1-nitro-1-deoxy-hexitols to 2,6-anhydro-1-nitro-1-deoxy-hexitols. The first method, heating the crystalline nitrodeoxyhexitol near or above its melting point, furnishes the 2,6-anhydronitrodeoxyhexitol in about 20% yield. The second method, refluxing a 10% solution of the nitrodeoxyhexitol in 1% sulfuric acid for 48 hours, affords the anhydro compound in about 40% yield. The third method, refluxing a 10% aqueous solution of the nitrodeoxyhexitol for 48 hours, produces the 2,6-anhydronitrodeoxyhexitol in about 65% yield. Anhydridization of a nitrodeoxyhexitol in 1% sulfuric acid also produces small amounts of hexonic lactone, while anhydridization of a nitrodeoxyhexitol in aqueous solution also produces small amounts of pentose.

Epimeric nitrodeoxyhexitols furnish the same 2,6-anhydronitrodeoxyhexitol in the same yield. Thus, the anhydridization reaction proceeds via a common intermediate, probably the α-nitroolefin. Accordingly, the separation of mixtures of epimeric nitrodeoxyhexitols, arising from aldose-nitromethane condensations, prior to

their anhydridization is unnecessary. In the cases examined, the 2,6-anhydronitrodeoxyhexitol capable of existing in the most stable conformation was the major product.

1-Nitro-1-deoxy-D-mannitol or -glucitol or a mixture of the two epimers, when anhydridized, furnish 2,6-anhydro-1-nitro-1-deoxy-D-mannitol. Catalytic reduction of this compound furnishes 2,6-anhydro-1-amino-1-deoxy-D-mannitol oxalate monohydrate in 85% yield. Deamination of the amino compound with nitrous acid affords the known, naturally-occurring 1,5-anhydro-D-mannitol (styracitol) in 41% yield.

Anhydridization of the sirupy mixture of nitrodeoxyhexitols obtained from the condensation of D-xylose with nitromethane produces 2,6-anhydro-1-nitro-1-deoxy-D-gulitol in 46% yield and a second product, probably 2,6-anhydro-1-nitro-1-deoxy-D-iditol, in 1% yield. Catalytic reduction of 2,6-anhydro-1-nitro-1-deoxy-D-gulitol, followed by deamination with nitrous acid, affords 1,5-anhydro-L-glucitol in 51% yield.

The second part of the dissertation is concerned with the addition of ammonia and of methanol to the olefinic linkage of acetylated carbohydrate C-nitroolefins.

The action of methanolic ammonia on D-arabo-3,4,5,6-tetraacetoxy-1-nitro-1-hexene gives 2-acetamido-1-nitro-1,2-dideoxy-D-mannitol in 57.5% yield, and 2-acetamido-1-nitro-1,2-dideoxy-D-glucitol in 10.4% yield. Application of the Nef reaction (using hydrochloric acid) to the D-manno isomer furnishes the known D-mannosamine hydrochloride in 93% yield; while the Nef reaction with the D-glucosamine isomer under the same conditions produces the known D-glucosamine hydrochloride in 85% yield.

The action of methanolic ammonia on D-xylo-3,4,5,6-tetraacetoxy-1-nitro-1-hexene gives amorphous products. Application of the Nef reaction (using hydrochloric acid) to the sirup furnishes the known D-glucosamine hydrochloride in 15% over-all yield.

The methoxide catalysed addition of methanol furnishes 2-O-methyl-1-nitro-1-deoxy-alditols. The addition of methanol to D-arabo-3,4,5,6-tetraacetoxy-1-nitro-1-hexene gives 2-O-methyl-1-nitro-1-deoxy-D-mannitol in 38.4% yield. Application of the Nef reaction to this compound, followed by treatment with phenylhydrazine, affords the known 2-O-methyl-D-mannose phenylhydrazone in 74% yield. Cleavage of the hydrazone with benzaldehyde furnishes 2-O-methyl-D-mannose in quantitative yield.

The addition of methanol to D-erythro-3,4,5-triacetoxy-1-nitro-1-pentene produces a sirup which, upon acetylation, gives 2-O-methyl-1-nitro-1-deoxy-D-ribitol triacetate in 26.6% yield. Deacetylation with sodium methoxide affords 2-O-methyl-1-nitro-1-deoxy-D-ribitol in 93% yield. Application of the Nef reaction to this compound, followed by treatment with benzylphenylhydrazine, produces 2-O-methyl-D-ribose benzylphenylhydrazone in 62% yield. Treatment of the product from a Nef reaction with p-toluenesulfonylhydrazine gives 2-O-methyl-D-ribose p-toluenesulfonylhydrazone in 66% yield. Cleavage of 2-O-methyl-D-ribose benzylphenylhydrazone with benzaldehyde gives sirupy 2-O-methyl-D-ribose in 52% yield. The product thus obtained however, is not analytically pure. Microfilm \$2.75; Xerox \$4.40. 83 pages.

THE CHEMISTRY AND PHOTOCHEMISTRY OF GAMMA-TROPOLONE METHYL ETHER

(L. C. Card No. Mic 61-466)

Daniel Jerome Pasto, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Orville L. Chapman

The chemistry and photochemistry of gamma-tropolone methyl ether (I) has been studied for comparison with similar reactions of tropone and alpha- and beta-tropolone methyl ethers. Treatment of I with methyl Grignard gave 2-methyl-4-methoxy-3,5-cycloheptadienone (II) and 1-hydroxy-1-methyl-4-methoxy-2,4,6-cycloheptatriene. Similar treatment of tropone gave 2-methyl-3,5-cycloheptadienone and 2-methyltropone. Lithium aluminum hydride reduction of I gave 5-methoxy-2,4-cycloheptadienone (III), 4-methoxy-3,5-cycloheptadienol (IV), and 5-methoxy-2,4-cycloheptadienol (V). Tropone on similar treatment gave 3,5-cycloheptadienone and 3,5-cycloheptadienol (VI). The proof of structure, chemistry, and the spectra of these compounds are fully discussed.

Irradiation of I with ultraviolet light gave a single photoisomer, 5-methoxybicyclo[3.2.0]hepta-3,6-diene-2-one (photo-gamma-tropolone methyl ether). The ring opening reactions of this compound and the dihydro- and tetrahydro-derivatives are discussed along with other reactions. Treatment of I with maleic anhydride gave a single adduct in which the maleic anhydride has condensed across carbons 4 and 7, the same atoms bridged during the photoisomerization reaction, but a light-catalyzed Diels-Alder reaction could not be realized.

The Thesis also contains a discussion of the photochemistry of 1,3-cycloheptadienes. Irradiation of 1,3-cycloheptadiene gave bicyclo[3.2.0]hept-6-ene and the irradiation of the alcohol obtained by reduction of II, and the dienes III, IV, V, and VI gave the corresponding bicyclo[3.2.0]heptyl derivatives. The pyrolysis of the cyclobutene compounds thus obtained was studied along with some hydrolysis reactions.

In addition the Thesis contains sections on the kinetics of the acid- and base-catalyzed hydrolysis of I, hydrogenation of I in neutral and acidic solutions, hydrogenation of gamma-tropolone in neutral solution, and a preliminary investigation into the photochemistry of 4,5-benzo-2-phenoxytropone.

Microfilm \$3.70; Xerox \$13.05. 288 pages.

KETONIZATION OF A DIENOL AND THE SYNTHESIS AND PROPERTIES OF BICYCLO(2.2.2.)-2,5,7-OCTATRIENE (BARRELENE).

(L. C. Card No. Mic 60-6571)

Robert Michael Paufler, Ph.D.
Northwestern University, 1960

Adviser: Howard E. Zimmerman

PART I- Previous research had indicated that ketonization of dienols yields preferentially the unstable product, the β - γ -unsaturated carbonyl compounds. This work was

however confined to experiments in which the ketonizing medium was either not very acidic or of undefined acidity. In these cases it may be primarily the enolate which is being protonated to afford unconjugated products. In literature experiments in which the ketonizing medium was very acidic such as in the sulfonation of cholest-4-en-3-one and where the enol acetate was used directly, the stable product, the conjugated isomer resulted. Upon this previous research and the results found here, it was suggested that the enol protonated preferentially to afford the stable isomer (the α,β -unsaturated carbonyl compound) while the enolate protonates preferentially to give the less stable isomer (the β,γ -unsaturated carbonyl compound).

Cholesta-3,5-dien-3-ol was used as a model because both of its products of ketonization, cholest-5-en-3-one and cholest-4-en-3-one, were known. As expected there was a pH dependence of product distribution. At high pH the less stable isomer, cholest-5-en-3-one, was almost exclusively produced while at low pH a 50-50 mixture was obtained; controls were run to correct for any equilibration of the unstable to the stable isomer. From this data it appeared that the proposed hypothesis was essentially correct. Also the enol ether of cholesta-3,5-dien-3-ol when ketonized at pH 2 gave 95% of the more stable product while only 7% under the reaction conditions could derive from equilibration. This experiment, which eliminates the enol-enolate equilibrium and therefore the enolate, gives further support for the hypothesis.

PART II- The previously unknown bicyclo(2.2.2.)-2,5,7-octatriene was the subject of the second part of this research. Interest in this compound was due to the arrangement of the p-orbitals of the double bonds which might overlap giving some aromatic character to bicyclo(2.2.2.)-2,5,7-octatriene (barrelene). The name barrelene derives from the barrel shaped electron cloud.

Bicyclo(2.2.2.)-2,5,7-octatriene was synthesized via an eight step route utilizing α -pyrone and methyl vinyl ketone as starting materials. The resulting diacetylbicyclo(2.2.2.)-2-octene was then converted in five steps to a bis-quaternary ammonium hydroxide which upon pyrolysis yielded the desired bicyclo(2.2.2.)-2,5,7-octatriene in a 33% yield.

Proof of structure depended heavily on hydrogenation to the known bicyclo(2.2.2.)octane, the nuclear magnetic resonance spectrum and the thermal decomposition to benzene and acetylene. Barrelene in many of its reactions was similar to the analogous compounds, bicyclo(2.2.1.)-2,5-heptadiene and bicyclo(2.2.2.)-2,5-octadiene, in that it only added one mole of bromine and tetracyanoethylene. N.m.r. evidence indicated the dibromo adduct might be the homotricyclene derivative but is not conclusive. Simple molecular orbital calculations indicated electron delocalization but no delocalization energy.

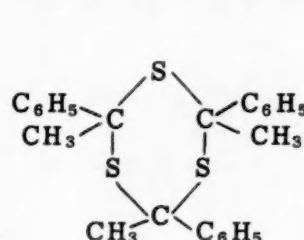
Microfilm \$2.75; Xerox \$4.60. 86 pages.

THE REACTIONS OF SUBSTITUTED ACETOPHENONES WITH HYDROGEN SULFIDE

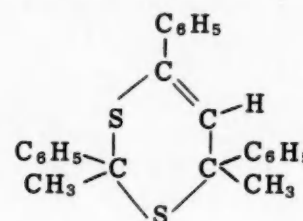
(L. C. Card No. Mic 60-6316)

John Dominic Pera, Ph.D.
Indiana University, 1960

The literature indicates that acetophenone reacts with hydrogen sulfide in hydrochloric acid-ethanol solution at 5° to give a violet solution of thioacetophenone and that this then trimerizes to trithioacetophenone (I). On standing, the filtrate precipitates a second crystalline solid, "anhydrotriacetophenone disulfide" (II).



I



II

In this study, a third compound isolated from the "anhydro" mother liquor was found to be isomeric with the "anhydro" compound and was converted to 2,4-diphenylthiophene by reaction with copper chromite in boiling xylene.

An extensive series of reactions was conducted with ortho-, meta- and para-substituted acetophenones in alcoholic-hydrogen chloride solutions treated with hydrogen sulfide. With o-fluoro- and o-chloroacetophenone, both the trimer and the "anhydro" compounds were obtained. o-Hydroxyacetophenone did not react to give a thioketone and o-methoxyacetophenone yielded a resinous polymer of the thioketone.

The only meta-substituted acetophenone which yielded a trimer was m-fluoroacetophenone. The chloro-, bromo-, iodo-, methoxy- and hydroxyacetophenones gave only resinous polymers.

With the para-substituted acetophenones, the fluoro-, chloro-, bromo- and iodoacetophenones yielded both the trimer and the "anhydro" compounds. Temperatures of 5° or less led to a larger proportion of trimer compared to "anhydro" derivative, while higher temperatures gave increased yields of "anhydro" compounds. The only product obtained from the reaction with p-methoxyacetophenone was a resinous polymer. Neither trimer nor "anhydro" compound was obtained from p-hydroxyacetophenone. An unstable red oil and a dark red-green crystalline solid were also obtained. The structure of the solid was not elucidated completely but it appears to have quinone-like properties as well as properties of a universal indicator since the color of an alcohol solution ranges from yellow at pH 2.9, through red, purple, blue and green at pH 12.

An "anhydro" compound was obtained with p-nitroacetophenone as well as an unknown yellow solid containing mercaptan groups. 3,4-Dichloroacetophenone, 1-acetonaphthone and 2-acetonaphthone yielded only linear polymers.

The "anhydro" compounds and resinous polymers from the meta- and para-substituted acetophenones were converted to 2,4-diarylthiophenes by refluxing them in

xylene with copper chromite for varying periods of time. However, neither the products from the ortho-substituted acetophenones nor the resins obtained from the *m*-methoxyacetophenone and *m*-hydroxyacetophenone could be converted to the thiophene derivatives.

Ultraviolet spectra of the 2,4-diarylthiophenes were obtained and a comparison of these spectra demonstrated the effect of various substituents on the spectra of a conjugated system.

Reactions of β -benzoylpropionic acid with hydrogen sulfide and hydrogen chloride in acetic acid solution yielded a yellow crystalline solid identified as 4,4'-thiobis-4-phenyl-3-butenic acid.

Microfilm \$2.75; Xerox \$6.00. 123 pages.

A KINETIC STUDY OF THE INTERCONVERSION OF MONOARYL ALCOHOLS AND MONOARYL OLEFINS

(L. C. Card No. Mic 61-60)

Henry John Peterson, Ph.D.

The Pennsylvania State University, 1960

The equilibrium constants and the forward and reverse rates of interconversion of $\text{XC}_6\text{H}_4\text{C}(\text{CH}_3)\text{CH}_2$ and $\text{XC}_6\text{H}_4\text{C}(\text{CH}_3)_2\text{OH}$ were measured spectroscopically in aqueous sulphuric acid at 25.0°. In the general formula X is equal to 4-nitro, 4-methoxy, 4-carboxy, 4-chloro, 3-chloro, 4-methyl or hydrogen.

In each case it was found, for a particular alcohol-olefin pair, that the rate of hydration was about 5-15 times faster than the dehydration, and the equilibrium was in favor of the alcohol.

The equilibrium constants were independent of substituent and acid concentration, and they were identical within a factor of 3 for the compounds studied.

The rates of hydration, k_1 , and dehydration, k_{-1} , of the 4-nitro, 4-methoxy and unsubstituted alcohol-olefin pairs were studied as a function of acid concentration. Both $\log k_1$ and $\log k_{-1}$ were equal to $-\log a_{\text{H}^+}$. It was concluded that all of the alcohol-olefin pairs investigated have the same acidity dependence.

The logarithms of the rates of hydration and dehydration, determined in 20.2% H_2SO_4 at 25.0°, were found to be proportional to σ^+ with a rho value of -3.21 and -3.0, respectively.

It was concluded that the mechanism for the interconversion of the α -methylstyrenes with their α - α -dimethylbenzyl alcohols is essentially the same as that for the aliphatic alcohol-olefin interconversion, and that any differences are in degree rather than kind.

A transition state for the interconversion of substituted α -methylstyrenes and their corresponding alcohols has been proposed.

It has been demonstrated that the application of the Zucker-Hammett theory to this study was invalid.

The solubility of salicylic acid in 0-60% aqueous sulphuric acid was studied spectroscopically at 25.0°. On the basis of the activity coefficient behavior of salicylic acid, calculated from its solubilities, it was concluded that it was a member of a class of neutral organic molecules which display almost identical changes in activity coefficient in various concentrations of sulphuric acid.

The solubility of bis-(1-naphthylmethyl)ammonium perchlorate was studied spectroscopically at 25.0° in 0-40% aqueous sulphuric acid. The rate of change of activity coefficient with sulphuric acid concentration, calculated from the solubility data, was shown to be identical with that of 2'-(N,N-diethylamino)-1'-phenylethyl 4-nitrobenzoate perchlorate, tetraphenylphosphonium perchlorate and tetrabutylammonium perchlorate. This identity refuted several hypotheses advanced to account for the difference between the H_R and the H_O acidity functions.

The equilibrium ratios of picrate ion to picric acid were determined spectroscopically at 25.0° in 0-60% aqueous sulphuric acid. The derivatives of the logarithms of the concentration ratios, $d \log (\text{picrate})/(\text{picric acid})$, were found to be equal to $-dH_O$.

Microfilm \$2.75; Xerox \$6.60. 137 pages.

PART I: THERMAL ALKYLATION AND ISOMERIZATION OF ALKYL BENZENES. PEROXIDE-INDUCED ISOMERIZATION OF ALKYL BENZENES.

PART II: THE STUDY OF THE DEHYDRATION OF ALCOHOLS OVER ALUMINA.

(L. C. Card No. Mic 60-6573)

C. Narayana Pillai, Ph.D.

Northwestern University, 1960

Part I

Thermal reactions of toluene, ethylbenzene and cumene with 1-butene, of toluene with 2-butene and of toluene, o-, m- and p-xylene and p-methylanisole with propylene were studied in a flow system at 410 atmospheres and 430-490°.

2-Butene was found to be less reactive than 1-butene towards the benzyl radical.

The selectivity of the addition of the aralkyl radical to 1-butene increased in the series toluene, ethylbenzene, and cumene. In their reactions with propylene, toluene, the three xylenes and p-methylanisole showed essentially the same selectivity. These results are discussed and the conclusion is drawn that steric factors associated with the adding radical and the olefin are mainly responsible for determining selectivity.

The thermal alkylations were accompanied by 1,2-phenyl migration. The thermal reaction of cumene alone under the conditions of the alkylation also resulted in phenyl migration as indicated by the formation of n-propylbenzene. Addition of a radical initiator like dibenzyl increased the extent of this phenyl migration.

Phenyl migration was further investigated by a systematic study of the products formed during the decomposition of peroxides in alkylbenzenes. Decomposition of di-t-butyl peroxide in cumene and in t-butylbenzene yielded in addition to the products previously reported in the literature, n-propylbenzene in small yield and isobutylbenzene, respectively. t-Amylbenzene under similar conditions yielded 2-phenyl-3-methylbutane and 1-phenyl-2-methylbutane. Peroxides giving rise to more reactive free radicals, namely, benzoyl peroxide and acetyl peroxide also caused similar isomerizations, but to a lesser extent.

Part II

The dehydration of alcohols over different alumina catalysts was studied.

Catalysts prepared from sodium aluminate are only weakly acidic and do not cause much isomerization of olefins during dehydration. Catalysts prepared from aluminium isopropoxide are strongly acidic and cause extensive isomerization of olefins during dehydration. This isomerization activity could be suppressed by exposing the catalyst to bases like ammonia, piperidine and trimethylamine, before using them for dehydration. Such modified catalysts are excellent where dehydration of alcohols with a minimum of rearrangement is desired.

On the basis of products obtained by the dehydration of menthol and neomenthol, it was shown that dehydrations which proceed by 1,2-elimination show preferred trans orientation. When neopentyl-type alcohols, which dehydrate with rearrangement are dehydrated over alumina, the major product of rearrangement is the one having the double bond in the 2,3-position with respect to the hydroxy group. Thus neopentyl alcohol gives 2-methyl-1-butene and pinacolyl alcohol gives 2,3-dimethyl-1-butene as the main rearrangement products. d-Borneol yields tri-cyclene and optically active camphene. Probable mechanisms for these reactions are discussed.

Microfilm \$2.75; Xerox \$9.25. 202 pages.

BOROXINES: THEIR REACTIONS AND RING STABILITY.

(L. C. Card No. Mic 60-6679)

Thomas Paul Povlock, Ph.D.
The University of Florida, 1960

The reaction of trimethoxyboroxine with Grignard reagents was studied. Using the reaction conditions of a nine to one mole ratio of Grignard reagent to trimethoxyboroxine at 25°C, the following borinic acids were prepared and isolated as the anhydride: di(n-propyl), di(iso-propyl), di(n-butyl), di(sec-butyl), di(n-amyl), and dicyclohexylborinic acid. Only the di(n-butyl)borinic acid had previously been reported. Using the same reaction conditions, the author prepared and reported (1) the preparation of eight aryl borinic acids, four of which had been previously reported.

Di-Grignard reagents prepared from 1,4-dibromobutane and 1,5-dibromopentane were reacted with trimethoxyboroxine in an attempt to prepare cyclic borinic acids. The results were inconclusive.

The reaction of phenylmagnesium bromide and triphenylboroxine was also shown to proceed to yield the borinic acid.

From a study of the effects of temperatures, ratio of trimethoxyboroxine to Grignard reagent, solvent, steric factors, and the competition between trimethoxyboroxine and trimethyl borate, a mechanism has been postulated.

Microfilm \$2.75; Xerox \$3.80. 69 pages.

THE THERMAL DEGRADATION OF N-1-NAPHTHYL CARBAMATES AND RELATED COMPOUNDS

(L. C. Card No. Mic 60-5372)

Robert Emms Read, Ph.D.
University of Delaware, 1960

Supervisor: Elizabeth Dyer

In an investigation of the mechanism of formation of carbon dioxide during the pyrolysis of N-1-naphthyl carbamates, the carbamates were heated at temperatures ranging between 133° and 285°. The rates of decarboxylation have been investigated and the pyrolysis products identified.

When heated for a long time at 133° or for a short time at 255°, O-1-hexadecyl N-1-naphthyl carbamate decomposed to form di-1-hexadecyl carbonate and N,N'-di-1-naphthyl urea. Carbon dioxide evolution accompanied the formation of these products. The formation of the products may be explained by a nucleophilic attack of the initially formed 1-hexadecanol on the carbamate. The reaction was shown to be reversible at 275° by the formation of O-1-hexadecyl N-1-naphthyl carbamate on heating a mixture of di-1-hexadecyl carbonate and N,N'-di-1-naphthyl urea. Both the carbonate and urea formed carbon dioxide when heated between 255° and 275°.

When heated between 255° and 275°, O-1-hexadecyl N-1-naphthyl carbamate decomposed to form carbon dioxide, N-1-hexadecyl N-1-naphthyl amine, 1-hexadecanol, and 1-naphthyl isocyanate trimer. The carbon dioxide and secondary amine were formed in nearly equivalent amounts. The lack of appreciable amounts of carbonate and urea products, together with the lack of appreciable amounts of carbonate and urea degradation products and the ready reaction of carbonate and urea at 275°, indicate that the carbonate and urea were reaction by-products rather than important intermediates acting as sources of carbon dioxide under these high temperatures. The rate of carbon dioxide evolution followed a first-order rate law for approximately 30% of reaction. The Arrhenius activation energy for the rate of carbon dioxide evolution was about 34 Kcal./mole.

When the N,N-di-substituted carbamate, O-1-hexadecyl N-1-propyl N-1-naphthyl carbamate, was heated at 265° to 280°, the carbamate slowly decomposed, forming carbon dioxide, N-1-propyl N-1-naphthyl amine and 1-hexadecene as major products. The rate of carbon dioxide evolution obeyed a first-order rate law for over 60% of reaction. The Arrhenius activation energy was about 62 Kcal./mole.

When heated between 255° and 280°, 1-naphthyl isocyanate condensed with the formation of carbon dioxide and N,N'-di-1-naphthyl carbodiimide. At these high temperatures, the carbodiimide quickly formed a yellow product thought to be closely related to a carbodiimide trimer. The rate of carbon dioxide evolution followed a second-order rate law for about 8 to 9% of reaction, then sharply increased as the result of autocatalysis by products. The uncatalyzed reaction had an activation energy of about 50 Kcal./mole. The reaction was catalyzed at these high temperatures by N,N'-di-1-naphthyl urea and N,N'-di-1-naphthyl carbodiimide.

The formation of carbodiimide from isocyanates at 133° was accomplished by using aluminum isopropoxide

or metal naphthenates as catalysts. The carbodiimides were stable at the lower temperature. N,N'-Di-1-naphthyl carbodiimide and poly(methylene bis(p-phenyl carbodiimide)) were prepared in high yield using the above catalysts.

O-1-Hexadecyl N,N'-di-1-naphthyl pseudourea ether was shown not to be a degradation intermediate in the formation of carbon dioxide from O-1-hexadecyl N-1-naphthyl carbamate at 275°. When heated under pyrolysis conditions, the pseudourea ether formed carbon dioxide, 1-naphthyl amine, N,N'-di-1-naphthyl urea, 1-hexadecene, 1-hexadecanol, and carbodiimide "trimer." No N-1-hexadecyl N-1-naphthyl amine was isolated from the pyrolysis residues of the pseudourea ether.

O¹⁸-Enriched O¹⁸-1-hexadecyl N-1-naphthyl carbamate and O¹⁸-1-hexadecyl N-1-propyl N-1-naphthyl carbamate were pyrolyzed at 275° in a study of the mechanism of carbon dioxide formation from O-1-hexadecyl N-1-naphthyl carbamate. Microfilm \$2.75; Xerox \$9.00. 200 pages.

STUDIES IN ADSORPTION CHROMATOGRAPHY

(L. C. Card No. Mic 60-6085)

David Dean Reed, Ph.D.
University of Oregon, 1961

Adviser: LeRoy H. Klemm

I. Chromatography on alumina.

An investigation was made of the relationship of molecular structure and properties to chromatographic adsorbability on alumina for arenes, biaryls and alkenyl-arenes. A solution in petroleum ether or petroleum ether-benzene of two (or sometimes three) compounds was added to a prepared column of alumina (3×10^{-4} to 4×10^{-4} g. of adsorbates per g. of alumina) and the adsorbate components were subsequently eluted into arbitrary fractions by means of the same solvent. The compositions of the residues remaining from the evaporation of these fractions were investigated by melting point determination. The orders of increasing adsorbability (same as the orders of appearance in the effluent) found and semi-quantitative estimates of the degree of separation of the components were as follows: naphthalene < 2-vinylnaphthalene < phenanthrene (very good); anthracene < pyrene (fair); naphthalene < 1-phenylnaphthalene (very good); naphthalene < 1,1'-binaphthyl (complete); anthracene < 9-phenylanthracene (fair); 1-(1-naphthyl)cyclopentene < 2-phenylnaphthalene (good); 1-phenylnaphthalene < 2-phenylnaphthalene (complete); 9-phenylanthracene < 1-phenylanthracene (fair); 1-phenylanthracene < 2-phenylanthracene (complete); 1,1'-binaphthyl < 1,2'-binaphthyl (good); 1-vinylnaphthalene < 2-vinylnaphthalene (fair); 1-(1-naphthyl)cyclopentene < 1-(2-naphthyl)cyclopentene (fair); 1-(1-naphthyl)cyclohexene < 1-(2-naphthyl)cyclohexene (complete); 1-(1-naphthyl)cyclopentene < 1-(2-naphthyl)cyclohexene (fair); 2-vinylnaphthalene < 1-(2-naphthyl)cyclopentene (fair); 1-(2-naphthyl)cyclohexene < 1-(2-naphthyl)cyclopentene (poor); 3,4-benzphenanthrene < pyrene < triphenylene (virtually none; very good); chrysene < naphthacene (complete); triphenylene < chry-

sene (fair); 1,2-benzanthracene < chrysene (poor); 1,2-benzanthracene < naphthacene (complete).

The Law of Inequalities, i.e., if (in adsorbability) $A > B$ and $B > C$, then $A > C$ was found to hold. Moreover, adsorbability was found to increase with increasing (a) number of carbon-carbon double bonds present and (b) degree of intramolecular coplanarity existing in the compound. No valid correlation was found to exist between adsorbability and polarographic half-wave reduction potential, melting point or solubility.

From the observation that adsorbability relationships were closely analogous to those found for fostering stability in π -type molecular compounds in solution, it is proposed that adsorption on alumina also involved π -type complexation where the "active sites" on the alumina are electron-attracting areas on which the electron-donating hydrocarbon substrate is held monomolecularly and preferentially (where sterically possible) in a planar configuration parallel to the surface.

II. Chromatography on impregnated silicic acid.

Binary mixtures of α - and β -substituted naphthalenes (each approximately 10^{-4} M. in isooctane) were investigated by down-flow frontal analysis for relative chromatographic adsorbability on silicic acid impregnated with picric acid (TNP) or 2,4,7-trinitrofluorenone (TNF). Effluent samples were collected periodically and the optical densities, read at two selected wavelengths, were used to calculate the concentration of each component in the binary mixture. The amount of each component retained on the column was obtained by difference between total influent and total effluent. The relative adsorbabilities found and the impregnants used were as follows: 1-(2-naphthyl)cyclohexene > 1-(1-naphthyl)cyclohexene (TNF and TNP); 1-(2-naphthyl)cyclopentene > 1-(1-naphthyl)cyclopentene (TNF and TNP); 1-(2-naphthyl)cyclohexene > 1-(1-naphthyl)cyclopentene (TNF); and 2-phenylnaphthalene > 1-phenylnaphthalene (TNF).

Consistent with the data for displacement analysis of binary mixtures from alumina, the more nearly coplanar β -substituted naphthalene was adsorbed more tenaciously. It is proposed that impregnated silicic acid columns are characterized by (a) adsorption of the polynitro complexing agent, A, on the surface of the silicic acid to form "active sites" upon which (b) hydrocarbon substrate, H, is adsorbed. (c) Adsorption of H on A is identifiable with molecular compound formation in solution.

The use of impregnated silicic acid columns was extended to the resolution of two racemic aromatic compounds. Using optically active α -(2,4,5,7-tetranitro-9-fluorenylidene aminoxy)-propionic acid as the impregnant and petroleum ether as developer, racemic 3,4,5,6-dibenz-9,10-dihydrophenanthrene (I) and 1-naphthyl 2-butyl ether (II), were partially resolved by elution chromatography. By selective recombination and rechromatography of effluent fractions, samples were obtained exhibiting maximum $[\alpha]_D^{24}$ values of -1300° (c 0.014, benzene) for I, $+7^\circ$ (c 0.143, petroleum ether) for II; reported $[\alpha]_{5791}^{22}$ -1307° (c 0.525, benzene)¹ for I, $[\alpha]_D^{29}$ -7.4° (c 2.03, ethyl acetate)² for II.

It is postulated that resolution was achieved through molecular complexation (between impregnant and aromatic compound) on the surface of the silicic acid.

1. D. M. Hall and E. E. Turner, J. Chem. Soc., (1955) 1242.
2. M. S. Newman and W. B. Lutz, J. Am. Chem. Soc., 78, 2469 (1956).

Microfilm \$2.75; Xerox \$7.20. 154 pages.

STUDIES IN THE STRUCTURAL DETERMINATION OF SENEENIN

(L. C. Card No. Mic 61-62)

Louis Paul Reiff, Ph.D.
Pennsylvania State University, 1960

Senegin, a saponin from the plant *Polygala senega*, was isolated by hot alcoholic extraction of the powdered roots. On acid hydrolysis, the material yielded a sapogenin, senegenin. Previous work had suggested a molecular formula of $C_{30}H_{46}O_8$ or $C_{30}H_{44}O_8$, and dehydrogenation studies indicated, but did not establish, a tetracyclic nucleus. The oxygen functions were attributed to two carboxyl groups, two hydroxyl groups, and a lactone. The object of the present study was, then, to continue the structural elucidation of senegenin.

The oxygen assignments were confirmed chiefly by means of the NMR spectrum of the dimethyl ester diacetate. Two acetate and two methyl ester peaks were observed, as well as some indication of vinylic unsaturation. Furthermore, the acetate absorption suggested a 1,2 glycol arrangement of the original hydroxyl groups. The lactone must be at least six-membered as no absorption occurs in the infrared characteristic of five-membered lactones.

The existence of a double bond was proven by NMR, ultraviolet spectra attributable to an isolated trisubstituted double bond, and reaction with perbenzoic acid. Resistance to hydrogenation must also mean that the double bond is endocyclic. With proof of ethylenic unsaturation, the tetracyclic nature of the molecule is also established, as neither formula suggested could accommodate a pentacyclic nucleus including a double bond. This permits assignment of $C_{30}H_{44}O_8$ as the molecular formula of senegenin. Analyses of all the derivatives were in quite good agreement with formulas based on this value.

On reaction with perbenzoic acid, the six-membered lactone of the dimethyl ester diacetate was found to shift to a five-membered lactone, giving a new hydroxyl group and double bond. This meant that the lactone carbonyl and the original double bond are in a 1,2 or 1,3 relationship to each other. The new hydroxyl group, formed from the alcoholic function of the original lactone, is probably tertiary, as it resisted acetylation and was easily dehydrated. This was confirmed by reduction of senegenin to the hexaol, from which only a pentaacetate could be formed.

Cleavages of senegenin and derivatives with lead tetraacetate were studied. Senegenin and its hexaol were found to absorb two moles oxidant, while the dimethyl ester reacted with only one. This behavior may be explained on the basis of an α,β -dihydroxycarboxylic acid function in senegenin. Such a system would react with two moles of the reagent, and upon reduction would give a 1,2,3-triol, also requiring the absorption of two moles in its cleavage.

Protection of the carboxyl group by esterification prevented its oxidation, and cleavage proceeded with one mole at a rate indicative of a cis configuration of the hydroxyl groups. Proof of this was also obtained by formation of an isopropylidene ketal with acetone. The NMR spectrum of the dimethyl ester cleavage product showed retention of both methyl ester peaks, so that the alpha carbon atom must be further attached to the nucleus. The cleavage of the free acid proceeded with loss of one carboxyl group and formation of another. This was shown by analysis, titration, and the NMR spectrum of the esterified product.

To investigate the side chain of the nucleus, the acid-catalyzed fission of the side chain and identification of the resulting hydrocarbon by gas chromatography was attempted. Failure to detect any hydrocarbon fragment was interpreted to denote an oxygenated side chain.

When subjected to basic hydrolysis, senegenin was converted to a new product which analyzed for loss of CO_2 , although it remained dibasic. Probably the lactone had undergone decarboxylation, and the product may be closely related to a C_{29} companion sapogenin also isolated from the same plant.

Microfilm \$2.75; Xerox \$5.40. 110 pages.

STUDIES ON THE STRUCTURE AND CHEMISTRY OF TENULIN

(L. C. Card No. Mic 60-3315)

Wilmer Albert Rohde, Ph.D.
The Florida State University, 1960

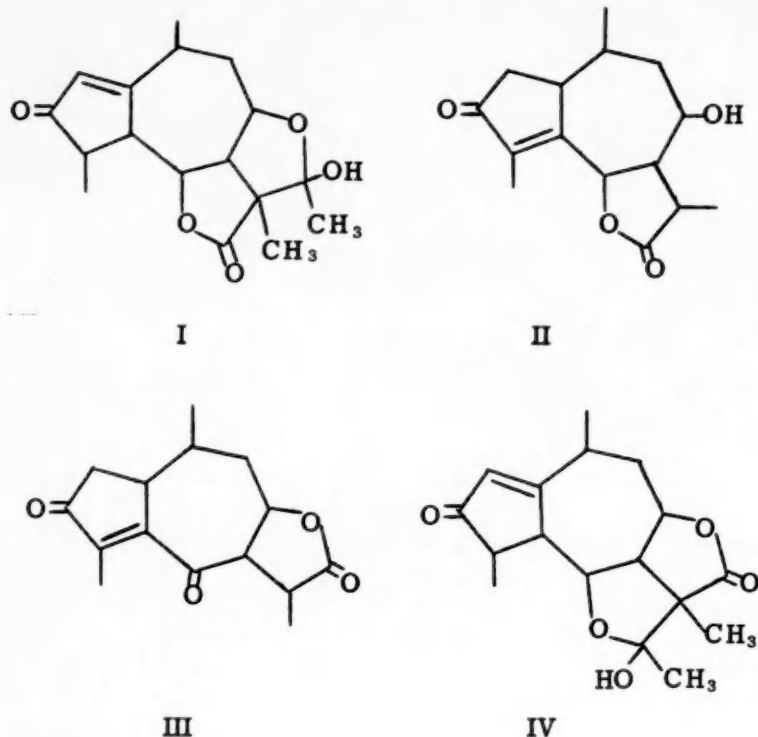
Barton and de Mayo¹ proposed structure I for the sesquiterpene lactone tenulin. The lactone ring orientation was based on its conversion to desacetylneotenulin to which structure II was assigned.

Braun, Herz and Rabindran² showed that treatment of dihydroisotenulin derivatives with alkali gives the isomeric allo series in which the lactone ring has the orientation found in helenalin^{3,4} (presumably closed toward C_8).

Since there was no independent proof for the orientation of the lactone ring as in I and II, this investigation had as its aim an inquiry into the factors which differentiate the "normal" from the "allo" and "neo" tenulin series.

It was shown that at least one, if not the only, difference between compounds of the normal and the allo series was the configuration at C_{11} . The properties of desoxodesacetyldihydroisotenulin indicated the absence of a methylene group α to the cycloheptanone carbonyl. This favors lactone orientation toward C_8 . Other evidence of a like nature is presented and a correlation with baldulin is described. On the other hand, base treatment of the mesylates of dihydrodesacetylneotenulin and its allo isomer gave different α,β -unsaturated lactones which suggests that the normal and the allo series differ in orientation of the lactone ring. Possible explanations for this discrepancy are advanced.

Treatment of tenulin with aqueous bicarbonate gave not only desacetylneotenulin, but three additional isomeric substances. Oxidation of desacetylneotenulin yielded two isomeric dehydro derivatives whose ultraviolet spectra were superimposable and agreed with the postulated structure III. Catalytic reduction of desacetylneotenulin



yielded desoxodesacetylneotenulin. Reductive ozonolysis of the latter furnished a monoketodiols which gave a positive iodoform test. It consumed periodate, but not in the theoretical amounts.

Treatment of the mesylates of desacetylneotenulin and desoxodesacetylneotenulin with base gave a dienone (λ max 287,213 m μ) and a diene (λ max 249 m μ), respectively. This strongly suggests that the lactone ring of desacetylneotenulin is closed toward C₈ which would require revision of the tenulin structure to IV. However, it is pointed out (a) that the elimination reaction may be accompanied by a rearrangement, and (b) that in spite of previous arguments to the contrary, there exists pathways for the conversion of tenulin to desacetylneotenulin which allow for a lactone ring reorientation.

The assignment of absolute configuration to the various asymmetric centers is discussed.

1. D. H. R. Barton and P. de Mayo, *J. Chem. Soc.*, 1956, 142.

2. B. H. Braun, W. Herz and K. Rabindran, *J. Am. Chem. Soc.*, 78, 4423 (1956).

3. G. Büchi and D. Rosenthal, *J. Am. Chem. Soc.*, 3860, 78 (1956).

4. W. Herz and R. B. Mitra, *J. Am. Chem. Soc.*, 80, 4876 (1958).

Microfilm \$2.75; Xerox \$6.20. 127 pages.

A. THE TRITERPENES OF
HELIABRAVOA CHENDE.
B. THE SYNTHESIS AND PROPERTIES OF
SOME α,β -UNSATURATED VALEROLACTAMS.

(L. C. Card No. Mic 61-63)

Paul Daniel Rosenstock, Ph.D.
The Pennsylvania State University, 1960

A.

A sample of the water-insoluble, "nonglycosidic," extracts of the giant Mexican cactus *Heliabrayoa chende* (formerly *Lemaireocereus chende*) has been investigated for triterpenes and found to be a good source of oleanolic acid, erythrodiol and oleanolic aldehyde. This is the first instance where the synthetically known oleanolic aldehyde has been found in nature.

B.

The condensation of sorbic acid and 2-styrylacrylic acid with amines has led to the formation of 1-substituted-6-methyl-5,6-dihydro-2-pyridone derivatives and 1-substituted-6-phenyl-5,6-dihydro-2-pyridone derivatives respectively. Reaction of these cyclic lactams with lithium aluminum hydride, lithium aluminum hydride-aluminum chloride, or mixed lithium aluminum hydrides yielded the corresponding substituted piperidines.

Dehydrogenation of 1-methyl-6-methyl-5,6-dihydro-2-pyridone and 1-phenyl-6-methyl-5,6-dihydro-2-pyridone with 5% palladium-on-carbon gave the corresponding 2-pyridone derivative. Prior to the present work synthesis of the latter pyridone would have been difficult.

Microfilm \$2.75; Xerox \$7.20. 155 pages.

SYNTHESIS OF POLYPHENYLS

(L. C. Card No. Mic 61-430)

Frank Scotti, Ph.D.
University of Maryland, 1960

Supervisor: Dr. G. Forrest Woods

This thesis is a report on the chemistry of the polyphenyls. A review of the literature has been made in order to compile the methods that have been reported for the preparation of polyphenyls. These methods have been classified into four major reaction groupings: 1) homolytic cleavage, 2) condensation, 3) Diels-Alder, 4) organo-metallics.

The research reported in this thesis is concerned with 1) the introduction of ortho, meta and para linkages in an order as may be desired in the polyphenyls; and 2) the determination of certain properties of some of the polyphenyls, particularly the melting points, infrared spectra and ultraviolet spectra.

A listing of the polyphenyls made in the course of the research in this Laboratory is presented under the headings; 1) linear, 2) singly-branched and 3) doubly-branched polyphenyls. Among these were three isomeric quinquephenyls, each of which contained an ortho, meta

and para link, but which differed in the order of the linkages. These are shown below.



These were of interest in connection with the question of how structurally similar different substances may be and yet be distinguishable. For these three substances the melting point was the most sensitive and the infrared and ultraviolet spectra and behavior toward vapor phase chromatography the least sensitive three of the four phenomena studied.

The preparation of a number of aryl substituted cyclohexanones, cyclohexanones and cyclohexadienes and bromopolyphenyls is reported which were obtained as intermediates in the synthesis in the polyphenyl series.

Microfilm \$2.75; Xerox \$6.40. 134 pages.

A PHYTOCHEMICAL INVESTIGATION OF LITHOSPERMUM RUDERALE

(L. C. Card No. Mic 60-6325)

Richard Gregg Shaw, Ph.D.
Indiana University, 1960

Attempts have been made to separate the gonadotrophically active constituents of aqueous extracts of Lithospermum ruderale by a variety of techniques including dialysis, metal precipitation, solvent precipitation, solvent extraction, paper electrophoresis, cellulose powder chromatography, ion-exchange chromatography, and silicic acid chromatography. Of these methods only dialysis and electrophoresis offered possibilities of an improvement in antigonadotrophic activity as measured by testing procedures developed by W. R. Breneman and co-workers.

The best dialysis procedure was found to be an eight hour dialysis of freeze-dried aqueous L. ruderale rhizome extracts against distilled water using Visking 20/32 inch thin-wall dialysis tubing as the barrier membrane. The antigonadotrophically active materials dialysed at a low rate. Calculations based on Craig's dialysis rate cell indicate that in the eight hour dialysis about ninety percent of the more rapidly dialysing, less active materials are removed while only about ten percent of the slower components are removed. Subsequent separatory operations, including electrophoresis, failed to improve consistently the activity of the material remaining inside the membrane (non-dialysate).

Electrophoretic methods, both paper strip and continuous paper curtain, showed a distinct separation of components found in the Lithospermum aqueous extracts. It was shown that the antigonadotrophically active materials carry a negative charge, i.e., migrate toward the anode. The activity does not move as a single sharp band -- rather, it moves as a wide band with a fairly high average mobility.

Electrophoresis of non-dialysate revealed that the majority of the materials being removed by dialysis were uncharged, i.e., the majority of the non-dialysate migrates under the influence of an electric field. After those materials which had undergone electrophoresis were allowed to stand for several months, a ninhydrin sensitive material was found which was cationic using the conditions of the original electrophoresis. This indicated that the cation was bonded during the first electrophoresis.

Bioassay results indicated doubt as to the possibility of separating Lithospermum materials into active and inactive fractions by acid or metal precipitation. Alcohol and acetone precipitation improved activity slightly but not reproducibly. Within the space of three days the precipitates resulting from these operations were found to have become insoluble in water and organic solvents with the exception of eighty-eight percent formic acid. The cause of insolubilization is believed to be due to a change in the inorganic constituents during precipitation. Although solvent precipitation of non-dialysate produced very little differential in activity among the different fractions, including the mother liquor, a definite series of weight peaks were found as more alcohol was added to the aqueous solution.

Anion exchange resulted in a reduction of the activity. Rutin and chlorogenic acids were identified by this procedure. Silicic acid chromatography of the ion-exchanged materials resulted in the separation of succinic acid.

Cellulose powder chromatography served to separate non-dialysates and alcohol precipitates into fractions but no significant improvement in activity was achieved. Spectra of certain fractions from these columns, electrophoretic fractions and alcohol precipitated fractions showed similarities in the infrared region. The spectra indicated that the main differences between all fractions was a difference in intensity of the two bands occurring at ca. 1700 and 1600 wave numbers.

The Lithospermum non-dialysate could be acetylated and benzoated. Although in each case materials were obtained whose solubility characteristics differed markedly, their infrared spectra did not. Acid hydrolysis of non-dialysate and alcohol precipitates of non-dialysate yielded two sugars -- arabinose and galactose or glucose, and at least seven ninhydrin sensitive spots, three of which are leucine, valine and alanine. All indications are that the active material(s) either is or is bound by a polymeric material. Microfilm \$3.60; Xerox \$12.60. 278 pages.

THE REACTIONS OF ALKOXIDE IONS WITH HALOFORMS

(L. C. Card No. Mic 61-69)

Ira H. Starer, Ph.D.
The Pennsylvania State University, 1960

An investigation of the reactions of alkoxide ions with haloforms has revealed a novel method of generating alkyl carbonium ions. The presence of alkyl carbonium ions was suggested by the isolation of normal and rearranged olefins, ethers, and halides. ROCX or ROC^+ has been proposed as the intermediate for the formation of this carbonium ion. The reaction involves the removal of an oxide ion from the alkoxide ion by the dihalocarbene, a de-oxidation.

Alkyl carbonium ions have also been shown to give rise to cyclopropanes. This has been demonstrated by the isolation of cyclopropane in the de-oxidation of potassium n-propoxide and in the nitrous acid deamination of n-propylamine.

Microfilm \$2.75; Xerox \$6.00. 125 pages.

SUBSTITUTION REACTIONS OF AROMATIC RESIN ACIDS

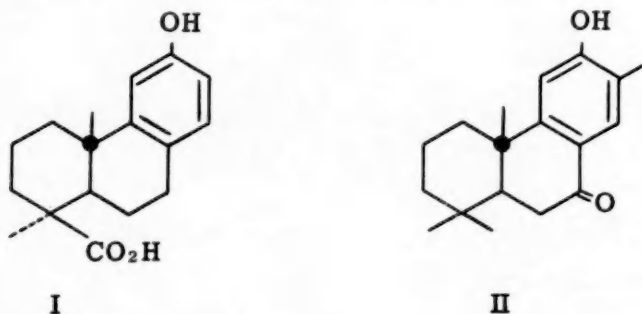
(L. C. Card No. Mic 61-474)

Virgil Irvin Stenberg, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Ernest Wenkert

In the conversion of the natural product, podocarpic acid (I), into other diterpenic compounds, alkylation of C-13 became of interest. Substitution of the aromatic ring of methyl podocarpate by alkylation of the sodium salt gave mainly O-alkylation.



More conventional methods were utilized to introduce necessary substituents. Methyl 13-methylpodocarpate could be prepared by first utilizing the Reimer-Tiemann procedure for the introduction of a formyl group at C-13 followed by catalytic reduction. Furthermore, 13-methylpodocarpic acid and 13-methylpodocarpinol were prepared via the Mannich reaction with subsequent formation of the quaternary ammonium salt and reduction with lithium in liquid ammonia.

The partial synthesis of nimbiol (II) was accomplished by converting 13-methylpodocarpic acid to the corresponding nitrile by preparation of the acid chloride and reaction with lithium amide. The amide, formed as a side product, was converted into the nitrile by dehydration. Lithium aluminum hydride reduction of the nitrile gave the corresponding aldehyde after acid hydrolysis. Reduction of the aldehyde to desoxynimbiol by the Huang-Minlon procedure was successful only after the phenol group was protected as the methoxymethyl ether.

Desoxynimbiol was also prepared from 13-methylpodocarpinol by forming the ditosylate and reduction of the tosylate with lithium aluminum hydride.

Several intermediates were prepared in the synthesis of abietic acid.

Microfilm \$2.75; Xerox \$6.40. 132 pages.

THE REACTION OF N-BROMOSUCCINIMIDE WITH AMINO ACIDS AND SOME RELATED COMPOUNDS

(L. C. Card No. Mic 60-6749)

George William Stevenson, Ph.D.
Stanford University, 1960

The object of this study was to investigate further the reaction of N-bromosuccinimide with amino acids and some related compounds in aqueous medium. The gases formed in these reactions were examined qualitatively by infrared and mass spectrometric analyses. Quantitative gas measurements were made in a Warburg apparatus. Other reaction products were determined by means of gas chromatography. The consumption of N-bromosuccinimide in the reactions with the various compounds was determined by iodimetric titration as well as by differential analysis of amino acids which were present in excessive amounts. The quantitative determination of the amino acids was performed with a Beckman Amino Acid Analyser.

The results of the experiments indicated that carbon dioxide and nitrogen are the only gases evolved by aqueous solutions of amino acids treated with N-bromosuccinimide at ambient temperature. In addition, nitriles and aldehydes corresponding to the decarboxylated parent amino acids were found. The yield of nitrile is greatest from amino acids with long carbon chains whereas the opposite trend occurred with the yield of aldehyde. The formation of aldehyde is accompanied by the liberation of an equal amount of ammonia which is subsequently oxidized to nitrogen by the N-bromosuccinimide. A minimum of two moles of the reagent are consumed per mole of amino acid. Higher consumptions were attributable to reactions of functional groups in the amino acid side-chain with the N-bromosuccinimide.

Microfilm \$2.75; Xerox \$3.80. 70 pages.

THE SYNTHESIS AND REACTIONS OF SOME SATURATED AND UNSATURATED FLUOROETHERS

(L. C. Card No. Mic 60-6681)

Eugene Curtis Stump, Jr., Ph.D.
The University of Florida, 1960

A study has been made of the peroxide and ultraviolet catalyzed free-radical addition of bromotrichloromethane, dibromodifluoromethane and 1,2-dibromo-2-chloro-1,1,2-trifluoroethane to alkenyl alkyl ethers. The alkenyl ethers selected for this work were allyl ethyl ether, allyl 2-chloro-1,1,2-trifluoroethyl ether, vinyl ethyl ether and vinyl 2,2,2-trifluoroethyl ether.

One-to-one addition products were obtained in each case, with radical attack occurring at the terminal methylene carbon atom.

Adducts of allyl ethers were obtained in low (26-50%) conversion with formation of appreciable amounts of high boiling material assumed to be telomers, while adducts of vinyl ether were formed in high (72-91%) conversion with little telomerization.

The addition products and/or their derivatives were

converted to unsaturated fluoroethers by dehydrohalogenation and dehalogenation reactions. Dehydrohalogenations were best accomplished with powdered potassium hydroxide in mineral oil, since undesirable side reactions occurred when the $\text{CF}_2=\text{CH}-$ group was formed in alcoholic base.

The α -bromoalkyl ethyl ethers were found to be highly reactive and thermally unstable, while the α -bromoalkyl 2,2,2-trifluoroethyl ethers exhibited markedly lower reactivity and higher thermal stability. This observation may be explained by the negative (electron withdrawing) inductive effect of the fluorine atoms which inhibits the ability of the oxygen atom to participate in the resonance forms shown when R' is $-\text{CH}_2\text{CF}_3$.



A 2-substituted fluoroalkoxy butadiene was prepared and found to homopolymerize readily to a white, crumb-like elastomer.

Microfilm \$2.75; Xerox \$4.20. 79 pages.

THE SYNTHESIS OF CERTAIN
 β -AMINODIBASIC ACIDS AND THE
PREPARATION OF POLYNITRO COMPOUNDS
DERIVED FROM THESE β -AMINO ACIDS

(L. C. Card No. Mic 60-6424)

William A. Swarts, Ph.D.
Purdue University, 1955

Major Professor: Dr. Henry Feuer

The object of this research was the preparation of polynitro monomers, particularly N-nitro-N-trinitroethylaminoalkyl diisocyanates, suitable for polymerization to polynitro polymers that could be used as rocket propellants. It has now been established that compounds containing both the N-nitro-N-trinitroethylamino and the acyl azide groups on the same carbon atom do not undergo a normal Curtius rearrangement to yield the expected isocyanates. Carbon monoxide and carbon dioxide were evolved as well as nitrogen during the decomposition of N-nitro-N-trinitroethylglycyl azide. The amounts evolved of the former two gases were highly temperature dependent, more carbon dioxide being evolved at high temperatures. N-Nitro-N-trinitroethylaspartyl azide and N-nitro-N-trinitroethylglutamyl azide could not be prepared. Compounds believed to be ethyl hydrogen N-nitro-N-trinitroethylaspartate, ethyl hydrogen N-nitro-N-trinitroethylglutamate, and N-nitro-N-trinitroethylaspartic anhydride were prepared during the course of the work on α -amino acids.

When it became obvious that the Curtius rearrangement did not proceed normally with α -N-nitro-N-trinitroethylamino acid azides, it became of interest to attempt the reaction with derivatives of β -amino acids. The successful preparation of 2-(N-nitro-N-trinitroethylamino)ethyl isocyanate, derived from N-nitro-N-trinitroethyl- β -alanil azide, demonstrated that the rearrangement proceeded normally if the N-nitro-N-trinitroethylamino group and the acyl azide group were on different carbon atoms.

It then became necessary to prepare fairly large

amounts of β -aminodibasic acids that could eventually be converted to β -(N-nitro-N-trinitroethylamino) α,ω -alkyl diisocyanates. Diethyl β -aminoglutarate hydrochloride was obtained in over 60% yield by adding ammonia across the conjugated double bond of glutaconic ester at 50-55° using ethanol as solvent, and then adding gaseous hydrogen chloride to an ethereal solution of the amino ester.

β -Aminoadipic acid was obtained in over 60% yield from the reaction of aqueous ammonia with 1,4-dicyano-2-butene (β -hydromucononitrile). The expected diisocyanates, 2-(N-nitro-N-trinitroethylamino)-1,3-propyl diisocyanate, and 2-(N-nitro-N-trinitroethylamino)-1,4-butyl diisocyanate, were subsequently obtained with little difficulty.

A new class of compounds, N-nitro-N-trinitroethylamino alcohols, have been prepared for the first time. The Mannich condensation among the amino alcohols, trinitromethane, and formaldehyde yielded the expected N-trinitroethylamino alcohols. Nitration produced N-nitro-N-trinitroethylaminoalkyl nitrates. The nitrate esters were converted to acetates with acetic anhydride and sulfuric acid at about 0°, and the acetates were subsequently hydrolyzed to the corresponding N-nitro-N-trinitroethylamino alcohols with methanolic hydrochloric acid. 2-(N-Nitro-N-trinitroethylamino)ethanol, 3-(N-nitro-N-trinitroethylamino)-1-propanol, and 2-methyl-2-(N-nitro-N-trinitroethylamino)-1,3-propanediol were synthesized in this way.

Microfilm \$2.75; Xerox \$9.00. 199 pages.

SILICON-SUBSTITUTED STYRENES:
THEIR SYNTHESSES, SPECTRA
AND REACTIONS.

(L. C. Card No. Mic 60-6825)

Joseph Vincent Swisher, Ph.D.
University of Missouri, 1960

Supervisor: Wesley J. Dale

As part of a series of studies on the syntheses, ultraviolet absorption spectra, and reactions of substituted styrenes, a number of silicon-substituted styrenes were prepared. The long conjugated systems in such styrenes and related compounds provide an opportunity for the resonance effect of the silicon group to be particularly apparent.

The trimethylsilylstyrenes were prepared by several methods. The reaction of *p*-vinylphenylmagnesium chloride with trimethylchlorosilane afforded *p*-trimethylsilylstyrene in good yields, and the applicability of this method for the preparation of other trimethylsilylstyrenes was investigated. Other syntheses for the trimethylsilylstyrenes proceeded via the trimethylsilylphenylmethylcarbinols, which were prepared either by the reaction of a trimethylsilylphenylmagnesium bromide with acetaldehyde or by the reaction of methylmagnesium iodide with the appropriate trimethylsilylbenzaldehyde. The styrenes were obtained from the carbinols in high yields by dehydration over alumina at 320°. The ultraviolet absorption spectra of *beta*- and *p*-trimethylsilylstyrene, when compared with that of styrene, show distinct shifts in the

absorption maxima toward longer wavelengths, indicating a resonance interaction of the trimethylsilyl group with the styrene system.

The trimethylsilyl-beta-nitrostyrenes and the trimethylsilylchalcones were prepared by the condensation of the trimethylsilylbenzaldehydes with nitromethane and acetophenone, respectively. When the trimethylsilyl group is conjugated with the beta-substituent in the above compounds, a bathochromic shift is observed in the ultraviolet absorption spectra. This can be interpreted in terms of the polarizability of the whole molecule or on the basis of a hyperconjugative effect of the trimethylsilyl group.

The trichlorosilylstyrenes were prepared by the chlorination of the trichlorosilylbenzenes followed by dehydrochlorination at 400-450°. Some routes for the preparation of the triphenylsilylstyrenes were also investigated.

The reaction of the trimethylsilylstyrenes with diazonium salts under Meerwein conditions led to trimethylsilylstilbenes, substituted with chloro, cyano, methoxy, and nitro groups. 4-Trimethylsilyl-4'-aminostilbene was obtained by the reduction of the corresponding nitrostilbene with hydrazine and Raney nickel. The parent stilbenes were prepared by the Meerwein reaction of styrene with the same diazonium salts, in order to compare their ultraviolet spectra with those of the corresponding trimethylsilylstilbenes. The ultraviolet spectra of the trimethylsilylstilbenes also show bathochromic shifts, due to the presence of the trimethylsilyl group, regardless of the nature of the group conjugated with it.

Copolymerization of styrene with p-trimethylsilylstyrene and with m-trimethylsilylstyrene gave the following reactivity ratios: for the para-isomer, $r_1 = 0.9$ and $r_2 = 0.7$; for the meta-isomer, $r_1 = 0.7$ and $r_2 = 0$. Thus, the meta- and para-isomers showed quite different reactivities in copolymerization reactions with styrene. The reactivity ratios given above for the copolymerization of p-trimethylsilylstyrene with styrene led to an e value of -0.12 or -1.48 and a Q value of 0.65 or 1.9.

It was evident from the ultraviolet absorption spectra of the conjugated systems containing the trimethylsilyl group and the copolymerization reactions, that the trimethylsilyl group exerts an electronic influence on the conjugated systems to a degree greater than that which would be expected on the basis of an inductive effect alone.

Microfilm \$2.75; Xerox \$7.40. 158 pages.

ARYLOXY AND RELATED ORGANOSILICON CHEMISTRY

(L. C. Card No. Mic 61-475)

William James Trepka, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Henry Gilman

The general purpose of the investigation was to synthesize unique silicon derivatives of aryloxy compounds and to explore more fully the fundamental chemistry of such systems.

By employing a mixed ether-tetrahydrofuran solvent system, the procedure for the dimetalation of diphenyl

ether by n-butyllithium was improved both in time of reaction and in yield of product.

A number of unsymmetrical phenoxasilin compounds was prepared. The procedure involved the preparation of the functional Si-H compound, 10-phenylphenoxasilin, from reaction of 2,2'-dilithiodiphenyl ether with phenylsilane. Reaction of the Si-H compound with a number of RLi reagents produced the desired unsymmetrical phenoxasilin compounds. The chemistry of the phenoxasilin system was explored briefly.

Some silicon derivatives of xanthene were prepared with substituents in the 9-positions. Two derivatives of 9,9-diphenylxanthene with nuclear substituents were also prepared. In connection with these reactions, it was found that xanthene could be metalated readily by triphenylsilyllithium.

A facile cleavage of methyl aryl ethers by triphenylsilyllithium to give methyltriphenylsilane and the corresponding phenolic compound was observed. The cleavage could not be extended to the ethyl or n-propyl phenyl ethers, probably due to the extreme steric sensitivity of triphenylsilyllithium. The cleavage was not facilitated by the use of less bulky silylmetallic reagents. A similar methyl cleavage was observed with symmetrical acetals.

Through the use of competitive reactions, several series of relative reactivities involving silylmetallic reagents were developed. They are as follows: (1) the relative reactivities of functional groups with triphenylsilyllithium, $C_6H_5OCH_3 < \underline{n}\text{-}C_8H_{17}F < C_6H_5Cl < C_6H_5CN$

$< C_6H_5COC_6H_5 < C_6H_5\overset{O}{\underset{|}{CH}}-CH_2 < (CH_3O)_3PO \approx C_6H_5COOC_2H_5$; (2) the relative reactivity of triphenylsilyllithium versus several organometallic reagents in coupling with chlorosilanes in tetrahydrofuran, $C_6H_5Li < \underline{n}\text{-}C_4H_9Li < (C_6H_5)_3SiLi$, differences which are more pronounced in mixed ether-tetrahydrofuran solvent systems; and (3) the relative reactivities of chlorosilanes in coupling with triphenylsilyllithium, $(C_6H_5)_3SiOC_2H_5 \ll (C_6H_5)_3SiCl = (C_6H_5)_3SiBr < (CH_3)(C_6H_5)_2SiCl < (CH_3)_2(C_6H_5)SiCl < (C_2H_5)_3SiCl = (CH_3)_3SiCl$.

Dimethylphenyl- and phenyldimethylsilanecarboxylic acids were prepared and characterized. The acids were found to become more stable to base as the number of alkyl substituents on silicon increased.

Microfilm \$2.75; Xerox \$8.60. 190 pages.

PART I: STUDIES TOWARD THE TOTAL SYNTHESIS OF VITAMIN D. PART II: SYNTHETIC STUDIES RELATED TO THE ACONITE-GARRYA ALKALOIDS. (A) SYNTHESIS OF MODEL NITROGEN COMPOUNDS. (B) SYNTHESIS OF OCTAHYDROPHENANTHRENE DERIVATIVES.

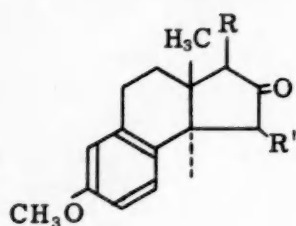
(L. C. Card No. Mic 61-259)

Jiro Tsuji, Ph.D.

Columbia University, 1960

The Dieckmann condensation of methyl 2-methyl-6-methoxytetralin-1,2-diacetate, which was synthesized from 6-methoxy-1-tetralone, was studied. Two structures

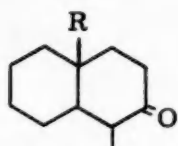
Ia and Ib are possible for the product of this Dieckmann condensation. One of these, Ia, would be an interesting intermediate for a vitamin D synthesis. It was found, however, that the Dieckmann condensation gave exclusively Ib. This result is explainable by the fact that the 1,3 interaction between the angular methyl group and the lower acetate group became less by forming a trigonal carbon in the transition stage leading to Ib.



Ia R = $-\text{CO}_2\text{CH}_3$, R' = H

Ib R = H R' = $-\text{CO}_2\text{CH}_3$

The intramolecular cyclization of several *trans*-2-decalone derivatives which have different groups at the C₁₀ position was tried as a possible model for the formation of the bicyclic amine system of the garrya alkaloid. In all cases, the carbonate ester IIa, the urethane IIb, the acetic ester IIc, the tosyl ester IId, the cyclization occurred at C₃. The intramolecular cyclization of ^{1,9}-octalone derivatives was also studied, but here again the cyclization occurred at C₃.



II a R = $-\text{CH}_2\text{OCO}_2\text{C}_2\text{H}_5$

b R = $-\text{CH}_2\text{NHCO}_2\text{C}_2\text{H}_5$

c R = $-\text{CH}_2\text{CO}_2\text{CH}_3$

d R = $-\text{CH}_2\text{CH}_2\text{OTs}$

The introduction of ^{3,4}double bond into the *trans*-2-decalone system to prevent C₃ alkylation or acylation was tried by bromination and dehydrobromination. It was confirmed that the bromination occurred at C₃, but dehydrobromination occurred with rearrangement and gave the ^{1,9}-octalone, excepting the case of 10-carbethoxy-1-methyl-2-tetralone which gave mainly ^{3,4}double bond. It was found possible, however, to introduce the desired ^{3,4}double bond via halogenation of the preformed 2,4-dinitrophenylhydrazones.

The synthesis of a possible precursor of the garrya alkaloid via the Bogert-Cook method was attempted: Cyclization of methyl 2(-*m*-methoxyphenylethyl)-3-carbethoxy-3-methylcyclohexaneacetate was tried in polyphosphoric acid. The only product which could be characterized was, however, the product of further cyclization of the acetic acid group which formed an indenone with the aromatic ring.

Microfilm \$2.75; Xerox \$6.60. 139 pages.

THE SYNTHESIS, CHARACTERIZATION AND ATTEMPTED POLYCONDENSATION OF 2,3,6-TRI-O-BENZOYL- α -D-GLUCOPYRANOSYL BROMIDE.

(L. C. Card No. Mic 60-6952)

William W. Wadsworth, Ph.D.
The Institute of Paper Chemistry,
affiliated with Lawrence College, 1961

A survey of the literature has shown that the Koenigs-Knorr reaction has wide applicability in the synthesis of simple glycosides and disaccharides. Recently, Haq and Whelan have shown that this applicability can be extended to the synthesis of the gentiodextrin series of sugars by means of a single polycondensation reaction. Using 2,3,4-tri-O-acetyl- α -D-glucopyranosyl bromide as a monomer, Haq and Whelan were able to produce the gentiodextrins with a maximum D.P. of nine and a maximum in the weight distribution curve at a D.P. of three.

The purpose of this dissertation was to study the applicability of the Koenigs-Knorr reaction to the synthesis of the cellodextrin series of oligosaccharides. Since the monomer required for this polycondensation reaction was a new compound, it was also desirable to characterize its reactivity by means of solvolysis reactions.

It was found possible to synthesize the desired monomer, 2,3,6-tri-O-benzoyl- α -D-glucopyranosyl bromide, by brominating 1,2,3,6-tetra-O-benzoyl- α -D-glucopyranose with titanium tetrabromide.

Eleven attempts were made to polycondense this material varying acid acceptors, solvent, and temperature of reaction. The results of these condensations showed that under the best conditions only cellobiose (β , 1-4 linkage) and maltobiose, and maltotriose could be obtained (α , 1-4 linkage). It should be noted that these products were only tentatively identified by paper chromatography.

Since the monomer was a bifunctional glucose molecule containing a C-1 bromide group and a C-4 hydroxyl group, the failure to undergo appreciable polycondensation must have been due to a relatively low reactivity of one or both of these groups. Recent reports in the literature have indeed shown that the C-4 hydroxyl is much less reactive than the C-6 hydroxyl. Also, it has long been an accepted fact that benzoate esters decrease the reactivity of a glucosyl halide due to steric hindrance. Based on these two facts, it would be expected that this attempt to synthesize the cellodextrins would be less productive than the synthesis of the gentiodextrins conducted by Haq and Whelan. Nevertheless, an experimental program was enacted to quantitatively evaluate the extent to which the bromide group was at fault.

This experimental program involved a comparison of the reactivity by solvolysis reactions in identical solvents of tetra-O-acetyl- α -D-glucopyranosyl bromide, tetra-O-benzoyl- α -D-glucopyranosyl bromide, and 2,3,6-tri-O-benzoyl- α -D-glucopyranosyl bromide. Before this comparison could be made, it had to be demonstrated that both O-benzoyl and O-acetyl glucosyl bromides would undergo methanolysis by the same reaction.

Newth and Phillips have studied the mechanism of solvolysis of O-acetyl glucosyl bromides and have concluded that the mechanism is S_N1 (unimolecular nucleophilic substitution) where the rate controlling step is the ionization or polarization of the C-1 halogen bond. In this

dissertation a study was made of the rate of solvolysis of the two benzoate substituted halides as a function of Lewis base strength. This study presented good evidence that the rate of solvolysis was independent of Lewis base strength. Therefore, it could be concluded that the two benzoate substituted glucosyl bromides studied underwent solvolysis also by the S_N1 mechanism. It was thus considered legitimate to compare the reactivities of the O-acetate and O-benzoate substituted glucosyl bromides by means of solvolysis reactions.

The rates of methanolysis in methanol:dioxane (9:1) fell in the order 2,3,6-tri-O-benzoyl- α -D-glucosyl bromide > tetra-O-benzoyl- α -D-glucosyl bromide > tetra-O-acetyl- α -D-glucosyl bromide. Although no data are available on the reactivity of 2,3,4-tri-O-acetyl- α -D-glucosyl bromide, it would be expected, based on the above data, that its reactivity would be greater than tetra-O-acetyl- α -D-glucosyl bromide and less than 2,3,6-tri-O-benzoyl- α -D-glucosyl bromide.

Although these solvolysis measurements were made only in a single solvent system, it was still possible to conclude that the O-acetate and O-benzoate substituted glucosyl bromides are of the same order of reactivity. From this assumption, it was possible to conclude that the lack of polycondensation of 2,3,6-tri-O-benzoyl- α -D-glucosyl bromide as compared with 2,3,4-tri-O-acetyl- α -D-glucosyl bromide was due entirely to the difference in reactivity of the C-4 and C-6 hydroxyl groups.

In the final phase of this dissertation, a comparison was made between the reactivity of 2,3,6-tri-O-benzoyl- α -D-glucopyranosyl bromide and tetra-O-benzoyl- α -D-glucopyranosyl bromide, as a means of assessing the importance of the C-4 benzoate ester on reactivity of the halide. These data show that the 2,3,6-tri-O-benzoyl- α -D-glucosyl bromide definitely has the higher rate constant at a given temperature. The differences in rate constants were shown to be due to statistically different activation energies and entropies; however, due to limitations in applying the theory of absolute rates to reactions in solutions, it was impossible to designate any meaning to these differences.

Microfilm \$2.75; Xerox \$5.80. 119 pages.

DI-n-ALKYLPHOSPHINE OXIDES, A NEW CLASS OF ORGANOPHOSPHORUS COMPOUNDS.

(L. C. Card No. Mic 60-4428)

Robert Hackney Williams, Ph.D.
Temple University, 1953

The di-n-alkylphosphine oxides, $R_2P(O)H$, represent a new class of organophosphorus compounds. They are probably tautomeric with the dialkylphosphinous acids, R_2POH , which are known only in the form of the esters, R_2POR . Earlier workers in the field had attempted to prepare dialkylphosphinous acids (dialkylphosphine oxides) by the hydrolysis of esters, R_2POR , or dialkylchlorophosphines, R_2PCl , where R was an alkyl group comprised of four carbon atoms or less. In these cases the expected dialkylphosphinous acids (dialkylphosphine oxides) were not obtained. Instead the product underwent disproportionation to the dialkylphosphine, R_2PH , and the dialkyl-

phosphinic acid, $R_2P(O)OH$. The existence of the di-n-alkylphosphine oxides depends upon the finding that the molecule is sufficiently stabilized by an increase in chain length beyond n-butyl so that the higher members may be characterized. The n-amyl, n-hexyl, n-heptyl, n-octyl, n-nonyl, n-decyl, n-undecyl, n-dodecyl, n-tetradecyl, n-hexadecyl, and n-octadecyl derivatives have been synthesized by the replacement of the butoxy groups in di-n-butyl phosphite, $(n-C_4H_9O)_2P(O)H$, with the alkyl group of the appropriate Grignard reagent, $RMgX$. As a proof of structure, di-n-octylphosphine oxide, $(n-C_8H_{17})_2P(O)H$, was synthesized from di-n-octylphosphinic acid, $(n-C_8H_{17})_2P(O)OH$, by replacement with hydrogen of the chlorine atom in the phosphinyl chloride, $(n-C_8H_{17})_2P(O)Cl$, using lithium aluminum hydride.

These higher di-n-alkylphosphine oxides are white solids and are moderately stable, neutral entities. The n-amyl, n-heptyl, and n-nonyl compounds are less stable than the members with even numbers of carbon atoms in their alkyl groups, di-n-undecylphosphine oxide being the first stable member of the odd series. The melting points of the di-n-alkylphosphine oxides increase with an increase in molecular weight.

The di-n-alkylphosphine oxides offered a convenient route to the preparation of the di-n-alkylphosphinic acids, only a few of which have been described in the chemical literature. Therefore a series of di-n-alkylphosphinic acids, in which the alkyl groups corresponded with those in the phosphine oxides, were prepared either through direct oxidation with hydrogen peroxide or by conversion of the phosphine oxide to the phosphinyl chloride followed by hydrolysis. In order to establish the identity of the di-n-alkylphosphinic acids unequivocally, they were also synthesized, in the case of the even numbered alkyl groups, by the anti-Markownikoff addition of normal 1-olefins to hypophosphorous acid, $H_2P(O)OH$. Organic peroxides were used as catalysts in this reaction.

The di-n-alkylphosphinic acids are weak acids and are highly stable, white solids. A plot of the melting points against the number of carbon atoms in an alkyl group shows an alternation in melting points, the odd numbered members melting lower than the immediately preceding even numbered member until the eleven carbon atom alkyl chain is reached. This is the first time that this effect has been noted in a series of organophosphorus acids.

Microfilm \$2.75; Xerox \$3.00. 57 pages.

CHEMISTRY, PHARMACEUTICAL

SYNTHESIS OF POTENTIAL ANTICANCER AGENTS: ANALOGS OF HEXESTROL AND THYMINE.

(L. C. Card No. Mic 61-270)

James L. Brannon, Jr., Ph.D.
University of Kansas, 1960

1. Statement of the Problem. Since the discovery that some tumors are hormone-dependent, hormones have become an important approach to cancer chemotherapy.

In view of the use of estrogens and adrenocortical hormones in the treatment of cancer, the synthesis of several analogs of the estrogen hexestrol (I), some containing a carbonyl in a position corresponding to C-11 of cortisone, were judged worthy of attention.

In addition, it was planned to synthesize a group of thymine analogs as possible antineoplastic agents of the antimetabolite class. Another group of compounds of increasing importance in the chemotherapy of cancer is the nitrogen mustards. A two-fold purpose would be realized if the nitrogen mustard grouping were attached to an antimetabolite thymine nucleus. An attempt was made to prepare a compound of this class.

2. Procedure. The intermediate cyanostilbenes were obtained by the alkaline condensation of a methoxylated phenylacetone with a methoxylated benzaldehyde. Treatment of *o,m*-dimethoxy- α -(*p*-methoxyphenyl)-cinnamitrile (II) with ethylmagnesium bromide gave the corresponding valeroneitrile (III). Reaction of III with methylolithium produced 3-(*p*-methoxyphenyl)-4-(*o,m*-dimethoxyphenyl)-2-hexanone (IV). Treatment of the intermediate cyanostilbenes with ethylmagnesium bromide followed by ethyl iodide gave a series of 2-ethyl-2,3-diarylvaleronitriles. The decyanation of these compounds with sodium in isoamyl alcohol gave 3-(*o,m*-dimethoxyphenyl)-4-(*p*-methoxyphenyl)-hexane (V), 3-(*m*-methoxyphenyl)-4-(*p*-methoxyphenyl)-hexane (VI), 3-(*o*-methoxyphenyl)-4-(*p*-methoxyphenyl)-hexane (VII) and 3-(*m,p*-dimethoxyphenyl)-4-(*p*-methoxyphenyl)-hexane (VIII). Both VI and VII were demethylated to give their respective hydroxylated compounds IX and X.

The condensation of an α substituted ethyl acetoacetate with thiourea led to a group of 5-benzyl-6-methylthiouracils which were hydrolyzed to the corresponding uracils, 5-benzyl-6-methyluracil (XI), 5-(*p*-chlorobenzyl)-6-methyluracil (XII) and 5-(*o,p*-dichlorobenzyl)-6-methyluracil (XIII). Methylation of XI and XII gave their respective 1-methyl derivatives XIV and XV and their 1,3-dimethyl derivatives XVI and XVII.

The Mannich reaction using uracil and thiouracil gave 5-piperidinomethylthiouracil (XVIII) and 6-methyl-5-piperidinomethyluracil (XIX) directly. Other compounds prepared in this group include the 5-dimethylaminomethyl derivative of uracil (XX) and thiouracil (XXI) and the methyl iodides (XXII) and (XXIII), respectively.

Attempts to prepare 5-[bis-(2-chloroethyl)-amino-methyl]-uracil (XXIV) by different routes has been unsuccessful.

3. Results Obtained. The planned hexestrol analogs (IV to X), and thymine analogs (XI to XXI) were synthesized. The desired uracil nitrogen mustard XXIV has not been obtained.

4. Conclusions. Owing to the fact that several of the hexestrol analogs were oils, pharmacological tests have not been carried out. It is planned to have a number of intermediate valeroneitriles tested for possible carcinolytic effect. Several of the uracils were screened against tumors in mice, but results were negative.

Microfilm \$2.75; Xerox \$5.80. 120 pages.

CHEMISTRY, PHYSICAL

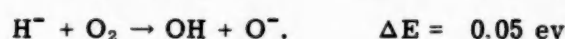
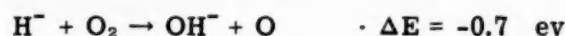
THE SCATTERING OF HYDRIDE AND HYDROXYL IONS IN OXYGEN

(L. C. Card No. Mic 60-6657)

Charles Edward Baker, Ph.D.
The University of Florida, 1960

The total and inelastic collision cross sections for H^- and OH^- ions in oxygen have been measured for ion beam energies of 4-350 ev. A cylindrical beam of momentum-analyzed, reasonably mono-energetic OH^- or H^- ions, produced by electron bombardment of water vapor, was passed through a scattering cylinder containing the scattering gas at pressures of $1-4 \times 10^{-3}$ mm of Hg. Elastically scattered ions were distinguished from slow charged particles produced by inelastic collisions by means of a retarding potential applied between a cylindrical grid surrounding the beam and an outer collecting cylinder. From the ratios of the currents to the various scattering elements to the total current, the total cross section, σ_T , and the inelastic cross section, σ_I , were calculated. The elastic cross section, σ_S , was taken to be the difference between σ_T and σ_I .

For H^- in O_2 , a plot of σ_I vs ion energy resulted in a curve which did not go to zero as the ion energy was decreased. On the basis of the retarding potential analysis and the adiabatic theory it was concluded that the high cross section at low ion energies was due to the following ion-molecule reactions:



For OH^- in O_2 , the inelastic cross section tended to zero as the ion energy was decreased. This would be expected since all of the inelastic processes for this system are endothermic. The retarding potential data indicated that the process making the major contribution to the inelastic cross section was electron detachment.

From a logarithmic plot of σ_S vs ion energy, a one-term interaction potential for OH^- in O_2 was calculated. On the assumption of an attractive interaction, the following potential function was obtained:

$$V = -\frac{11.5}{r^{4.50}}$$

over the range of interaction $0.84 - 2.23 \text{ \AA}$, where r is in angstroms and V in electron volts. The repulsive potential calculated was

$$V = +\frac{23.3}{r^{4.50}}$$

where the distance of closest approach ranged from $0.01 - 2.65 \text{ \AA}$. It was not possible to accurately determine the interaction potential for H^- in O_2 by the method used for OH^- in O_2 . Excitation of the O_2 molecule to the low-lying excited electronic state, $^1\Delta_g$, was concluded to be the major interfering factor.

Microfilm \$2.75; Xerox \$3.80. 68 pages.

ANIONIC POLYMERIZATION OF CYCLIC SILOXANES

(L. C. Card No. Mic 60-5624)

Edgar E. Bostick, Ph.D.
The University of Akron, 1959

A study has been carried out on the base-catalyzed polymerization of octamethylcyclotetrasiloxane (D_4) by means of various anionic initiators. These included potassium metal, potassium hydroxide, potassium methoxide, and sodium and potassium naphthalene, both in the presence or absence of solvents.

Sufficient evidence has been obtained to show that the chain length of the polymer is in accord with the general kinetics of the system. For ordinary base-catalyzed systems, this corresponds to one polymer chain per initiator molecule, in the absence of impurities, such as water, or of complicating reactions, such as silanol condensation at elevated temperatures. For polymerization catalyzed by alkali metal complexes of polynuclear aromatic compounds, there are two molecules of catalyst consumed per chain formed, with one dihydronaphthalene structure included in the chain.

Carbanions, such as those formed from the reaction of styrene or isoprene with alkali metals or organoalkali compounds, such as potassium naphthalene, are active in initiating siloxane polymerization. This gives rise to an efficient and rapid reaction at room temperature, when carried out in a highly solvating medium, such as tetrahydrofuran. By this means, it is possible not only to polymerize the siloxanes alone, but to synthesize a wide variety of block copolymers containing vinyl, diene, and siloxane segments. Some properties of such block copolymers are discussed.

Microfilm \$2.75; Xerox \$8.00. 174 pages.

PART I. RHEOLOGICAL PROPERTIES OF MOLECULES IN DACRON FIBER. PART II. RHEOLOGICAL PROPERTIES OF MOLECULES IN NYLON 66 FIBER. PART III. STATISTICAL THERMODYNAMICAL THEORY OF SURFACE TENSION.

(L. C. Card No. Mic 60-6224)

Seihun Chang, Ph.D.
University of Utah, 1960

Chairman: Henry Eyring

Part I

Using an extensometer, the stress-strain curves and stress-relaxation curves at constant strains were determined for Dacron at various temperatures ($38.4^\circ - 58.6^\circ\text{C}.$) and relative humidities ($31.6 - 29.7\%$). The fiber sample (monofil) was rested for various intervals of time between successive cyclic deformation (elongation and contraction). The upcurves of the stress-strain curves thus obtained crossed approximately at a point. It is concluded that below the convergent point, entangled molecules become disentangled and above the point disentangled molecules

begin to line up in parallel to each other. It was found that there were two types of stress relaxations. In one type, the stress decreased with time, and in the other, it increased with time. The relaxation phenomena were qualitatively well explained by the Eyring-Halsey model. The spring line observed was non-Hookean.

Part II

Using an extensometer, the stress-strain curves and stress-relaxation curves were determined for nylon 66 at various temperatures ($30 - 59^\circ\text{C}.$) and relative humidities ($28 - 75\%$). The fiber sample (monofil) was relaxed for various durations of time between successive cyclic deformations (elongation and contraction). The stress-strain curves thus obtained crossed approximately at a point. It is concluded that below the convergent point, entangled molecules become disentangled (a thixotropic breakdown), and above the point hydrogen-bond formation occurs between lined-up disentangled molecules. Stress-relaxation experiments were conducted with fibers under different conditions, and it was found that there were two types of relaxations. In one type, the stress decreased with time, and in the other, it increased with time. The relaxation phenomena were qualitatively well explained by the Eyring-Halsey mechanical model consisting of a non-Newtonian Maxwell unit in parallel with a spring. The spring line, which represents the stress-strain relation for the parallel spring, was also non-Hookean.

Part III

The surface tensions of Neon, Argon and nitrogen at various temperatures were calculated applying the method of significant structures in liquids. The results showed fairly good agreement with experimental observations.

Further, these calculations suggested a quite interesting relation between the density of a bulk liquid and the surface tension. The calculated surface tension is quite sensitive to the molar volume of bulk liquids, e.g., one percent increase in the liquid molar volume gives a surface tension increased from two to five percent. Only the top two layers of a liquid contribute to the surface tension near the melting. At higher temperatures more layers contribute significantly.

The transition zone between the gas and liquid phases become broader with increasing temperature.

Microfilm \$2.75; Xerox \$5.00. 96 pages.

DIFFUSION OF CATIONS IN VARIOUS SOIL SYSTEMS

(L. C. Card No. Mic 61-100)

Cheng-Yin Cheng, Ph.D.
University of Illinois, 1960

In soils, relatively immobile nutrient cations, such as Ca^{++} and K^+ , which are adsorbed on the soil colloidal surfaces move relatively slowly. Since plant roots are capable of growing into only limited feeding areas, it is very important, from an agronomic point of view, to know how and to what extent these adsorbed nutrient cations

move, so that proper fertilizer placement practices may be devised for effective crop production. Studies therefore were undertaken to establish the mode of movement of adsorbed cations in soils, and also to determine quantitatively some of the factors, such as soil moisture, free anion concentration, kind of cation-soils, etc., that affect such movement.

Na^{22} was used to trace cation-movement across an interface between 2 soils prepared as soil columns. These columns were 1.6 cm. long and 1 1/8 inches in diameter and were subjected to a pressure of 12,000 pounds per square inch. Cisne silt loam top-soil saturated with Na^+ , K^+ , Ca^{++} , and H^+ , respectively, was used in making the upper half of the soil columns; Cisne silt loam sub-soil saturated with Na^{22} and Na^{23} was used in making the lower half. The soil columns thus prepared were kept at 0, 50, and 100% relative humidities for various experimental periods, varying from 1 to 6 months. At the end of each period, each soil column was sliced into 6 even sections, and Na^{22} -activity in each section was determined by a Geiger-Müller counter.

When cation-movement occurred, it was indicated by a general increase in the Na^{22} -activity in the previously non-radioactive portion of the soil column. This activity increased with time and decreased with distance away from the interface. Water was found to play a very important role in the movement of adsorbed cations in soils. No measurable movement occurred in air-dry soils. For the soils studied the minimum amount of soil moisture necessary for measurable amounts of cation-movement to occur was about 5%. When an adequate amount of soil moisture was present, the rate of cation-movement appeared to be linearly proportional to the amount of free salt, or anion concentration, in soils. The rate of movement also was found to be dependent upon the kind of cations adsorbed on soil colloids into which the Na^{22} moved. The order of Na^{22} -movement into these soils was $\text{K-soil} > \text{Ca-soil} > \text{H-soil}$. Evidence obtained from this investigation indicated that the mode of movement of adsorbed cations in soils was exchange diffusion on the soil colloidal surface and its water layers. Contact exchange did not appear to be operative during such a movement process.

Fick's second law was applied to calculate the diffusion coefficients of Na^{22} moving into various cation-soils containing different Cl^- -concentrations. The values obtained for D were of the order of $10^{-9} \text{ cm}^2 \text{ sec}^{-1}$, varying linearly with the Cl^- -concentration. These values were applied to calculate the renewal rate of plant nutrient cations into old plant-root feeding areas. It was found that this rate was negligible in terms of a normal corn-growing season. This means that plant roots must penetrate into new feeding areas to obtain sufficient amount of adsorbed nutrient cations for growth.

The findings of this work indicate that banding of fertilizers in plant-root feeding areas is preferable to uniform application. Further, this work suggests that disposal of radioisotope waste in dry soils would provide for its maximum confinement.

Microfilm \$2.75; Xerox \$5.00. 100 pages.

INVESTIGATION OF ABSORPTION SPECTRA OF ADSORBED FILMS ON METALS BY MEANS OF A POLARIZATION SPECTROMETER

(L. C. Card No. Mic 61-441)

Donald Churchill, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Lawrence S. Bartell

The electronic absorption spectra of thin films adsorbed on opaque substrates are of interest in the study of many adsorption phenomena but have not been studied heretofore because of technical difficulties. In this investigation it is shown how the absorption spectra of films of molecular thickness adsorbed on metal slides may be determined from the analysis of polarized light reflected from the surface.

A polarization spectrometer for measuring the state of polarization of reflected polarized light is described. This instrument was used to determine the change in the state of polarization associated with the formation of adsorbed films on the surface. Data obtained for films of molecular thickness of Rhodamine B and α , β , γ , δ -tetraphenylporphine were used to calculate the absorption coefficients and refractive indices of the films. The absorption spectra for the films were found to be in good agreement with the solution spectra of these compounds and the molar extinction coefficients for the absorption bands in the films were not greatly different from those in solution. The refractive indices for the films exhibited anomalous dispersion at the positions of absorption. The results obtained from the measurements of strongly absorbing films confirmed the feasibility of obtaining electronic absorption spectra for very thin films adsorbed on reflecting surfaces. The method was shown to be sensitive enough to detect the presence of secondary absorption bands such as that responsible for the shoulder on the Rhodamine B absorption band.

The change in the phase differences of the reflected light resulting from the formation of these films on the surface showed anomalous behavior at the positions of absorption similar to the anomalous behavior of the refractive index. Similar measurements made of monolayer films of n -octadecylamine adsorbed on chromium exhibited anomalous dispersion near 390 millimicrons. While experimental difficulties prevented faithful reproduction of the anomalies, the frequency of occurrence and the similarity among them suggested that they represented a real optical absorption by the film rather than spurious behavior. It was concluded that this absorption was due to the formation of a complex between the amine and the substrate. The molar extinction coefficient of this adsorption complex was estimated to be about 5×10^2 .

Two possibilities were discussed for the surface-adsorbate interaction postulated for the films of n -octadecylamine adsorbed on chromium. It was suggested that a molecular complex was formed between the amine group and a chromium ion or chromium oxide molecule on the surface of the substrate. Alternately, a charge-transfer complex may have been formed between the amine and the metal or metal oxide. Suggestions were made for further investigations to elucidate the type of adsorption complex from the electronic absorption spectra of films of Lewis bases adsorbed on metals.

Microfilm \$2.75; Xerox \$5.60. 111 pages.

A POSTULATED MECHANISM FOR
THE CHEMILUMINESCENT REACTION OF
ZINC TETRAPHENYLPORPHINE AND
TETRALIN HYDROPEROXIDE FROM
A KINETIC STANDPOINT

(L. C. Card No. Mic 61-504)

David Ralston Cross, Ph.D.
Syracuse University, 1960

The kinetics of the catalyzed chemiluminescent reaction of 6×10^{-3} to 6×10^{-2} M/l tetralin hydroperoxide and 1×10^{-4} to 1×10^{-8} M/l zinc tetraphenylporphine in tert-butylbenzene solvent were studied over the temperature range of 136 to 156°C. The reaction was run in deaerated solutions, contained in evacuated and sealed-off tubes, allowing one to conveniently follow the relative chemiluminescent intensities and the remaining concentrations of peroxide and dye with time. The peroxide was determined by a precise iodometric "dead-stop" endpoint method, the porphine by spectrophotometric analysis, and the chemiluminescent intensities by a monitored IP-22 photomultiplier cell.

A fairly rapid dry-ice temperature reaction between the dye and peroxide was observed in the presence of light. Consequently, the final low temperature deaeration of the reaction solutions was carried out in the absence of direct light.

It was found that peroxide sublimed under high-vacuum yielded the lowest and most reproducible rates for the decomposition of the peroxide alone. These approximately first order rates were used to correct the total peroxide-dye reaction rates, determined under analogous experimental conditions.

The peroxide, dye, and chemiluminescent intensity data were analyzed graphically. It was deduced that the rates of peroxide, dye, and chemiluminescent decay were second-order, first-order with respect to both the peroxide and dye concentrations. The relative chemiluminescent intensities were shown to be proportional to the concentration of excited dye molecules and thus gave a direct measure of the relative rate of formation of these excited molecules. An initial parallel falling-off in the peroxide and chemiluminescent rate constants was observed. The peroxide, dye and chemiluminescent rate constants were greater as the initial dye concentration was made smaller for a given initial peroxide concentration. A slight lowering of these observed rate constants was observed in the presence of α -tetralone, found to constitute 90% of the total peroxide decomposition products. Although the dye products were not determined, spectrophotometric data showed that the dye was breaking down into smaller non-absorbing fragments.

Approximately 30 moles of peroxide were consumed per mole of dye, regardless of the initial concentrations of dye and peroxide and the temperature. These data and the calculated activation-energy data of 26 kcal. for peroxide decomposition, 21.4 kcal. for chemiluminescent decay, and 27 kcal. for the dye decomposition, suggest that the peroxide is decomposing mainly by way of breakdown of the dye molecules. Between 8 and 30 molecules of peroxide may be involved, depending upon the final stable dye breakdown products.

The similarity of the metallo phthalocyanine-peroxide and the metallo porphine-peroxide chemiluminescent

reactions suggests that an electron transfer mechanism is responsible for the excitation of the dye molecule into a higher energy state. It is postulated that the peroxide initially forms a complex at the metal atom site in the dye and then accepts an electron from the pi orbitals in the dye. Consequently, the activation energy for the homolytic splitting of the peroxide is lowered. A hydroxylated metal porphine is then formed and may undergo a rapid reaction with the peroxy free radical or with another peroxide molecule leading to the formation of the ketone, water, and an excited dye molecule, or an initial dye breakdown fragment. The energy released upon the formation of the water molecule provides the necessary over-all energy required for the excitation of the dye and the subsequent emission of fluorescent or chemiluminescent light.

Microfilm \$4.20; Xerox \$14.85. 326 pages.

THE KINETICS OF THE THERMAL
DECOMPOSITION OF METHYL VINYL KETONE

(L. C. Card No. Mic 60-5223)

Joseph John Demo, Jr., Ph.D.
The University of Connecticut, 1960

Methyl vinyl ketone was picked for a kinetics study for two reasons. One was to accumulate kinetic data for the decomposition of this ketone which could be compared with the work done by other investigators on the saturated ketones. Secondly, it was hoped that a reasonable explanation for nitric oxide catalysis of organic molecules containing methyl carbonyl linkages could be deduced.

The thermal decomposition study of methyl vinyl ketone was carried out in a static system using manometric techniques over a temperature range from about 540-590°C. Extensive product analyses were conducted for the uninhibited, the inhibited and the catalyzed decompositions using the Perkin Elmer Model 154A Vapor Fractometer and the Model 21 Infrared Spectrophotometer. A least squares program for computing the initial rate and the initial pressure using the IBM 704 Electronic Digital Computer was devised.

Both the over-all pressure increase and the disappearance of the ketone followed second order kinetics. The activation energies for the uninhibited decomposition ranged from 35 to 40 kilocalories/mole depending on whether $t_{x\%}$ or the absolute rate constant was used for the calculations. For $t_{12.5\%}$ the decomposition best fits the equation;

$$k = 1.72 \times 10^{13} e^{-37,550/RT} \text{ cc.mole}^{-1} \text{ sec}^{-1}$$

For the disappearance of the ketone, the activation energy was 37,080 calories/mole.

The major products for the uninhibited decomposition were carbon monoxide (CO), methane (CH₄), ethylene (C₂H₄) and propylene (C₃H₆). The minor products were hydrogen, ethane, ketene, benzene and small amounts of 1-butene, toluene and 1,3 butadiene. A six-fold increase in the S/V ratio reduced the rate about 12%. The maximum inhibition by propylene was about 10%. Pyrolyses of mixtures of acetone-d₆ and methyl vinyl ketone gave substantial amounts of CH₃D and CD₃CH=CH₂. No CHD=CH₂ was observed in these experiments. Nitric oxide (NO) was

rapidly used up and the only new product detectable in the catalyzed reaction as compared to the uninhibited was hydrogen cyanide (HCN). Analyses of the products at five minutes decomposition time for 60 mm of ketone with increasing amounts of NO showed an increase in the percentages of CO, CH₄, and C₂H₄, but a decrease in C₃H₆. The C₃H₆ formed during the reaction reached a maximum amount at about five minutes. The decomposition of propylene at 562.9°C was considered. The products for the decomposition of propylene were equal amounts of ethylene and methane with smaller amounts of hydrogen. Propylene at 562.9°C decomposed much more rapidly in the presence of ketone than when alone.

The reaction between HCN and water was considered. There was no detectable decomposition to nitrogen and CO as has been reported. Mixtures of HCN, water and NO also showed no tendency to decompose. A weight balance between the initial ketone and the products indicated that about five per cent of the weight cannot be accountable as volatile products.

A free radical mechanism has been postulated. The mechanism consists of short chains and the primary rate determining step is bimolecular rather than the usual unimolecular cleavage of a C-C bond. The mechanism written accounts quite well for the experimental percentages of the products at the beginning of the reaction and is in agreement with the observed kinetic data. It has been shown that the oxygen of the reacted nitric oxide ends up in carbon monoxide. A mechanism other than oxidation has been suggested for the nitric oxide catalysis of organic molecules with methyl carbonyl linkages. A free radical mechanism for the decomposition of propylene has been proposed. The work of previous workers on the saturated ketones has been summarized and compared to methyl vinyl ketone.

Microfilm \$2.75; Xerox \$8.00. 175 pages.

PHOTOPRODUCTION OF BERYLLIUM-7

(L. C. Card No. Mic 61-446)

Melvin Smith Foster, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: A. F. Voigt

The purpose of this investigation was to determine if photonuclear reactions producing beryllium-7 might be initiated in the bremsstrahlung beam of the Iowa State University synchrotron and to estimate the integrated cross sections of these reactions. The latter was accomplished by comparison with the known cross section of the Ta¹⁸¹(γ , n)Ta^{180m} reaction.

Target nuclei chosen for this study included Be⁹, B¹⁰ and B¹¹ in their natural isotopic abundances, C¹², O¹⁶ and Al²⁷. These were contained in target materials of metallic beryllium, amorphous boron powder, graphite, boric acid powder and metallic aluminum. Beryllium-7 was observed to have been formed in all of these materials with the exception of aluminum.

Samples were irradiated in a probe which extended into the donut of the synchrotron, yielding a bremsstrahlung flux nearly 10 times higher than that available outside the

donut. Counting of the product nuclide was accomplished through the use of a well-type scintillation crystal to detect the 477 kev gamma-ray which accompanies the decay in 12 percent of the transitions. A single channel analyzer was used to determine the half-lives and counting rates at the end of irradiation for the various samples through the use of a weighted least squares calculation. The average half-life was determined to be 53 \pm 3 days for all samples containing beryllium-7. In addition, a 256 channel pulse height analyzer was used to determine the spectra of the gamma-rays emitted by the samples. Some minor activities were found as impurities.

The integrated cross section for the reaction Be⁹(γ , 2n)Be⁷ was estimated from threshold to 45 Mev as 5 \pm 2 Mev-millibarns. This compares with the previously reported value of 1.2 \pm .2 Mev-millibarns for the reaction to 30 Mev. Errors quoted in this study are an estimate of the errors due to counting and the uncertainty in the integrated cross section used for comparison. Duplicate samples were run with but a single exception.

The integrated cross section for the photoproduction of Be⁷ from boron of natural isotopic composition was estimated as 1.9 \pm .6 Mev-millibarns to 45 Mev. This reaction had not been previously reported.

Photoproduction of Be⁷ from boric acid was not appreciably larger than expected from the boron content alone. The integrated cross section for the formation of Be⁷ from boron in boric acid was estimated to be (2.2 \pm .7) $\times 10^{-3}$ Mev-barns. The O¹⁶(γ , 4p5n)Be⁷ reaction was not observed.

In carbon, the photoproduction of Be⁷ was studied as a function of energy. The integrated cross sections to 45, 40, 35 and 30 Mev were estimated as (1.3 \pm .4) $\times 10^{-2}$, (7 \pm 2) $\times 10^{-3}$, (4 \pm 1) $\times 10^{-3}$ and (5 \pm 2) $\times 10^{-3}$ Mev-barns, respectively, by comparison with the Ta¹⁸¹(γ , n)-Ta^{180m} cross section. The estimate of the cross section at 30 Mev was a single determination; all others were duplicates. In addition, the cross section for the reaction to 45 Mev was compared with that of C¹²(γ , n)C¹¹ and estimated on this basis to be (1.5 \pm .3) $\times 10^{-2}$ Mev-barns.

No Be⁷ production from aluminum was observed. However, the reaction Al²⁷(γ , 2p3n)Na²² was observed and the integrated cross section for this reaction was estimated as (1.0 \pm .3) $\times 10^{-2}$ Mev-barns to 45 Mev.

Microfilm \$2.75; Xerox \$3.00. 60 pages.

COMPLEX IONS IN FUSED SALTS

(L. C. Card No. Mic 61-447)

Harmon Mark Garfinkel, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Frederick R. Duke

Complexing constants for the species Ag⁺Cl⁻, AgCl₂⁻, Ag⁺Br⁻, and AgBr₂⁻ in molten NaNO₃-KNO₃ were determined by means of a concentration cell with transference. Silver-silver nitrate electrodes, which were shown to follow the Nernst limiting law to within \pm 0.5 mv, were used and the e.m.f. was followed as a function of the concentration of the halide ion employed. Deviations from ideal behavior were ascribed to complex ion formation.

The bromo-complexes were found to be more stable than the corresponding chloro-complexes and the stability of the complexes decreased with increase in temperature.

The negative deviations increased as the ion fraction of potassium increased and ΔF° for Ag^+Cl^- was found to be a linear function of the ion fraction of potassium. This effect was ascribed, in part, to a reduction in the Coulombic repulsion between the solvent cation around chloride and the silver ion as the solvent was changed from sodium nitrate to potassium nitrate. When potassium nitrate was replaced by cesium nitrate in the mixture the negative deviations became greater than those observed in the NaNO_3 - KNO_3 mixture.

Moreover by means of a reversible Ag , AgBr(s) electrode the stability constants of the species PbBr^+ , PbBr_2 , CdBr^+ , CdBr_2 , and CdBr_3^- were determined by following the change in potential of a concentration cell as metal nitrate was added. The values of these constants agreed quite well with those in the literature determined by other methods. The Ag , AgBr(s) electrodes were shown to follow the Nernst limiting law and served very satisfactorily as a reference electrode in molten alkali nitrates.

The "chemical" and physical approaches were compared and shown to be hardly distinguishable when applied to the experimental data. It was felt that one must look beyond thermodynamics to choose between them; otherwise the choice must be a matter of personal preference.

Microfilm \$2.75; Xerox \$6.20. 126 pages.

THE NEAR ULTRAVIOLET ABSORPTION SPECTRA OF FORMYL FLUORIDE AND DEUTERO-FORMYL FLUORIDE

(L. C. Card No. Mic 60-6148)

Lorrain Eugene Giddings, Jr., Ph.D.
Vanderbilt University, 1960

Supervisor: Professor K. Keith Innes

The near-ultraviolet absorption spectra of formyl fluoride and deuterio-formyl fluoride were studied between 2050 Å and 2680 Å. Each showed a maximum extinction coefficient of about 50 l./cm.-mole at 2050 Å and about 0.01 at 2680 Å, where each has its origin. The instruments used were the Model 14 Cary recording spectrophotometer and the Jarrell-Ash 3.4 meter Ebert spectrograph. An IBM 650 computer was extensively used for handling data.

The spectra of both molecules consist of many sharp bands which are capable of classification in long progressions with an interval of 1100 cm^{-1} . Since all progressions originate in the ground state, 1100 cm^{-1} represents a frequency of the upper state. By analogy with previously known analyses of formaldehyde, the 1100 cm^{-1} frequency is assigned to the C-O stretching motion. Excitation of high quanta of this frequency implies that the C-O bond is considerably longer in the electronically excited state than in the ground state, since those vibrations are most excited which tend most to equalize equilibrium geometries.

The FCO bending frequency of about 460 cm^{-1} is prominent in both molecules. What appears to be an out-of-plane bending frequency of the whole molecule is

also prominent, with a value of about 370 cm^{-1} for formyl fluoride and 245 cm^{-1} for d-formyl fluoride. The appearance of an out-of-plane frequency implies that the equilibrium configuration of the excited molecule is non-planar. A further indication of non-planarity consists in an observed doubling of vibrational levels similar to that observed in ammonia and in the analogous excited state of formaldehyde. Doubling is of the order of 180 cm^{-1} for the observed levels of formyl fluoride and about 100 cm^{-1} for d-formyl fluoride.

Approximate rotational analyses were obtained for several bands of each molecule by successive trial and error calculations of the rotational fine structure. The analyses revealed, among other points, that the smallest moment of inertia of each molecule was increased by about 30% during the transition to the electronically excited state. This and other observations from the rotational analyses are consistent with the conclusions from the vibrational analysis, some of which are listed above. However the available data are not sufficient for a complete structure determination. Both the planar and the non-planar models (with out-of-plane angles up to 30°) are consistent with the rotational data, as long as the C-O distance and FCO angle are allowed to vary within fairly wide limits.

The direction of change of the dipole moment during the transition also cannot be fully established by the data. The rotational fine structure merely indicates that the direction is nearly perpendicular to the axis of smallest inertia. This model is consistent with what is known of the dipole moment change in formaldehyde.

Better resolution of the rotational fine structure of bands from several progressions of these molecules should establish both the excited state configuration and the direction of change of the dipole moment during the transition. It should be noted, however, that the resolving power observed in this study was about 150,000, and that so far no molecular spectra have been obtained at substantially higher resolving powers.

The origin of the band system of formyl fluoride was observed to be at 37330 cm^{-1} . d-Formyl fluoride shows a reasonable shift to an origin at 37402 cm^{-1} . Both figures are higher by 5000 cm^{-1} to 10000 cm^{-1} than values estimated from low resolution data for most carbonyl compounds. Microfilm \$2.75; Xerox \$5.60. 112 pages.

MOLECULAR STRUCTURAL STUDIES ON CASEIN

(L. C. Card No. Mic 60-6805)

William Givens Godbey, Ph.D.
University of Missouri, 1960

Supervisor: Charles W. Gehrke

Alpha- and kappa-caseins were prepared by precipitation from a 4.6 M urea solution. The alpha-casein was centrifugally separated as calcium-alpha-caseinate micelles from a 0.2 M CaCl_2 solution, 20°C , pH 7.0. Ca-free casein was also prepared with ion exchange resins, potassium oxalate precipitation, and dialysis. A method for the preparation of Ca-free solutions of

alpha-, kappa₁- and lambda-caseins was developed. Kappa-casein was composed of two fractions called kappa₁- and lambda-casein. These caseins were chemically and electrophoretically characterized. X-ray diffraction on the caseins show differences in R-group spacing and suggests the alpha-helical coil structure. Small-angle X-ray scattering studies of undenatured casein at pH 6.8 show the apparent electronic radius of gyration for alpha-casein as 33 Å and kappa-casein as 55 Å. Heating of alpha-, kappa₁-, and lambda-casein at 90°C did not change the radius of gyration. The action of rennin on alpha-casein did not change the radius of gyration; however, the action of rennin on kappa₁- and lambda-casein increased the radius of gyration by 12 Å. Differential thermal analysis studies were made on acid-precipitated, alpha-, and kappa-casein. The thermograms show endothermic reactions taking place at 45-60°C. The techniques of differential thermal analysis, wide-angle and small-angle X-ray scattering are useful in determining molecular structure. A theory of molecular structure, denaturation, polymerization, and interaction of casein molecules is postulated.

Microfilm \$2.75; Xerox \$5.60. 115 pages.

PARAMAGNETIC RESONANCE IN THE HEXAFLUOROCHROMATE III ION

(L. C. Card No. Mic 60-6764)

Anthony Victor Guzzo, Ph.D.
Washington University, 1960

Chairman: Lindsay Helmholz

The paramagnetic resonance spectra of the CrF_6^{3-} ion has been interpreted in terms of a treatment involving both molecular orbital and crystal field theories. Analysis of the parameters obtained from the above and from the work on the MnF_6^{3-} and FeF_6^{3-} systems, seems to indicate a large amount of delocalization of the magnetic d electrons, an effect not in accord with the usual ionic model of a fluoride complex. Estimates of the amount of charge transfer indicate that in antibonding T_{2g} orbitals, the electrons are ~30% in fluorine $2p\pi$ orbitals, ~80% in the central atom d levels, and ~-10% in the overlap region. (The negative value on the overlap term indicates less charge is in this region than would be there if the orbitals were non-bonding). In the twofold degenerate, antibonding E_g orbitals, which are occupied in FeF_6^{3-} , but not in either CrF_6^{3-} or MnF_6^{3-} , the electrons are ~35% in fluorine $2p\sigma$ orbitals and ~70-80% on the central ion.

Of major importance in the interpretation of the spectra was the environmental symmetry seen by the paramagnetic ion. For this reason the space groups of K_2NaAlF_6 and K_2NaGaF_6 were investigated and shown to be O_h - $\text{Fm}3m$. Structure factor calculations were undertaken to arrive at more accurate values for the Al-F and Ga-F bond distances; the values arrived at are $1.84 \pm .02\text{\AA}$ and $1.90 \pm .02\text{\AA}$, respectively.

Microfilm \$2.75; Xerox \$4.00. 74 pages.

A STUDY OF THE HYDROGEN STRETCHING REGION IN THE INFRARED

(L. C. Card No. Mic 60-6671)

Kenneth T. Knapp, Ph.D.
The University of Florida, 1960

In this study, the infrared spectra of fluorinated compounds containing the oxygen-hydrogen, the nitrogen-hydrogen, and the carbon-hydrogen bond were compared to similar non-fluorinated compounds. The region of interest was limited to the 5000 cm^{-1} to 2500 cm^{-1} range which includes the hydrogen stretching vibrations of these bonds.

Both fluorinated alcohols and carboxylic acids were examined to determine the effect of fluorination on the O-H stretching vibrations. The spectra of the alcohols were determined from both the pure compounds and the carbon tetrachloride solutions, while only the carbon tetrachloride solutions of the carboxylic acids were examined. Interesting shifts in both the free and the associated O-H stretching vibrations were noted. The free O-H and the dimer associated O-H stretching vibrations were shifted to a lower frequency when the compound contained fluorine. In contrast to this, the polymeric associated O-H stretching vibration was shifted to a higher frequency upon fluorination. The strong inductive effect of the highly electronegative fluorine atom was suggested as the possible cause for these shifts. The shifts to a lower frequency was attributed to the loosening of the oxygen-hydrogen bond of the -OH group, while the shift to the higher frequency was presumed to be caused by the loss of strength of the hydrogen bonding.

The nitrogen-containing fluorinated compounds also produced frequency shifts. An unexpected difference occurred with the symmetric and asymmetric free N-H stretching vibrations obtained from the spectra of the carbon tetrachloride solutions. The frequency of the symmetric vibration shifted while the frequency of the asymmetric vibration did not shift. The difference was attributed to the manner in which the atoms move in the two vibrations.

An additional peak located between the symmetric and the asymmetric free N-H stretching vibrations was observed in the spectra of the carbon tetrachloride solutions. No definite reason was offered for the additional peak. However, it was thought that the peak might be due to some type of combination band involving this peak and the symmetric free N-H stretching vibration, since both bands showed a similar frequency shift.

As in the case of the associated O-H stretching vibrations, the associated N-H stretching vibrations showed a shift to a higher frequency upon fluorination. The same explanation offered for the O-H cases was given for the N-H cases.

All the frequency shifts due to fluorination in the C-H stretching vibrations were to a higher frequency. This was attributed to the tightening of the carbon-hydrogen bond caused by fluorination.

A comparison among the fluorinated compounds was made. Several interesting trends were found, and some frequencies were assigned.

Microfilm \$2.75; Xerox \$5.20. 101 pages.

INFRARED SPECTRA OF DIMETHYL ACETYLENE CRYSTAL: INTERNAL ROTATION AND PHASE TRANSITION.

(L. C. Card No. Mic 61-254)

Raoul Kopelman, Ph.D.
Columbia University, 1960

IR spectra of 3 condensed phases of dimethyl acetylene are presented and analyzed. In both crystal phases methyl groups of adjacent molecules are interlocked, giving rise to a lattice mode of 205 cm^{-1} ; the corresponding potential barrier is 1500 cal/mole . Free internal rotation of the molecule is found in the high temperature crystal (and is indicated as well in the liquid). The space group is tetragonal (D_{4h}^{14} from the standpoint of x-ray crystallography, C_{4h}^2 from that of L.R. Spectroscopy). In the low temperature crystal the molecule is "frozen" by the environment into a staggered (D_{3d}) configuration. A potential barrier hindering internal rotation, 300 cal/mole , is calculated from a rotatory lattice mode of about 100 cm^{-1} . A proton $-\pi$ electron interaction is suggested. The second order phase transition is related to the onset of free internal rotation.

The isolated molecule is shown to require a D_{6h} point group for its satisfactory description. The emergence of this unexpected result originates with the presence of the internal rotational degree of freedom.

Microfilm \$2.75; Xerox \$3.00. 33 pages.

A STUDY OF THE FACTORS AFFECTING ADHESION OF EPOXY RESIN TO METALLIC SURFACE

(L. C. Card No. Mic 60-6447)

P. S. Sampath Kumaran, Ph.D.
University of Cincinnati, 1960

A study has been made of the adhesion of high polymeric materials to a metallic surface.

The method is based upon the measurement of the centrifugal force required to dislodge the polymer spot from an alloy steel rotor. A liquid epoxy resin which was cross-linked was used as the adhesive. The solvent was isopropyl alcohol and toluene in equal proportions by volume. The cross-linking agents were (1) ethylene diamine, (2) 1, 3 diamino propane, (3) 1, 6 hexamethylene diamine. These were added in equivalent proportions by weight. The films were considered cured when the band at 10.92μ (fundamental vibration of epoxy group) disappeared.

The factors considered were the following:

- (1). Nature of the polymeric material.
- (2). Concentration of the polymer in the solution.
- (3). Viscosity of the solution of the polymer at the time of application.
- (4). Thickness of the film.

Concentrated solutions were used to minimize the effects of the solvent.

I. The effects of the curing agents was studied using 1, 3 diamino propane and 1, 6 hexamethylene diamine, with 80 per cent of epoxy solution. The plot of adhesion versus thickness of the film for these two systems indicated higher values of adhesion for 1, 3 diamino propane. This was attributed to (1) closely packed net work, (2) greater number of hydroxyl groups per unit area of the surface at the interface.

II. The effects of concentration at the time of application was studied with 75 per cent, 80 per cent, 85 per cent, and 90 per cent of epoxy by weight. Ethylene diamine was used as the crosslinking agent. The adhesion values were plotted against thickness of the film. Adhesion increased with an increase in concentration up to a certain concentration and further increase in concentration decreased the adhesion. This was attributed to (1) on the side of lower concentrations, (a) to a small supply of adhering molecules, (b) to an increased internal stress due to evaporation of the solvent present in large quantity, (2) on the side of higher concentrations to incomplete wetting due to high viscous nature of the solution.

III. Effect of viscosity was studied with a solution of 75 per cent of epoxy and an equivalent amount of ethylene diamine. Rotors were coated at different viscosities. A plot of adhesion versus thickness for different initial viscosities showed that adhesion increases to a maximum and then decreases. The initial increase in adhesion was attributed to the formation of a small number of large essentially linear molecules with hydroxyl groups favoring adhesion. The low viscosity of the solution enabled them to orient themselves. At higher viscosities, the number of such molecules correspondingly increase resulting in chain entanglement, favoring more cross-linkings which restrict free movement. The higher viscosity of the medium offers maximum resistance to orientation.

Also a plot of adhesion versus thickness for a solution of 90 per cent of epoxy by weight and a solution of 75 per cent of epoxy by weight, both coated at the same viscosity, indicated that polar molecules resulting from the reaction adhered more strongly than non polar molecules.

IV. The dependence of adhesion on thickness is striking. For thinner films, the lower values of adhesion are due to smaller forces necessary for the distention of the material after the adhesive failure had occurred right below the peak of the spot. Internal stresses due to the rapid evaporation of the solvent also account for the low adhesion values. For thicker films, greater force is necessary for the distention of the matter; also there is a chance for stress relaxation in the body of the spot, due to the presence of solvent for a longer period, in the body of the film.

Microfilm \$2.75; Xerox \$4.00. 71 pages.

THE THERMAL EXPANSION OF CERTAIN ALKALI HALIDES AND THEIR SOLID SOLUTIONS

(L. C. Card No. Mic 61-50)

Herbert Alden McKinstry, Ph.D.
The Pennsylvania State University, 1960

A high temperature x-ray diffractometer furnace was developed which has low thermal gradients in the region

of the sample and allows the necessary alignment adjustments. The furnace made possible the high precision lattice measurements at elevated temperatures needed for the determination of thermal expansion coefficients by the x-ray method. The furnace was used to measure the thermal expansion coefficients of single crystals of KCl, KBr, and NaCl from RT to 600°C. Powdered samples from the same specimens were found to give expansion coefficients indistinguishable from those obtained from the single crystal (within 2%). These same samples were also measured by a dilatometer technique using an interferometer and/or an optical lever system to measure the change in length. The results of these measurements were found to be the same as the x-ray measurements, within 3% experimental error.

LiF was measured as a single crystal by the x-ray method only. The average linear thermal expansion coefficients for these samples can be described by the interpolation formulae:

$$\bar{\alpha}(\text{KCl}) = (34.94 + 1.719 \times 10^{-2}T) \times 10^{-6}$$

$$\bar{\alpha}(\text{KBr}) = (38.24 + 1.667 \times 10^{-2}T) \times 10^{-6}$$

$$\bar{\alpha}(\text{LiF}) = (32.76 + 1.911 \times 10^{-2}T) \times 10^{-6}$$

$$\bar{\alpha}(\text{NaCl}) = (38.50 + 1.729 \times 10^{-2}T) \times 10^{-6}$$

where T is given in °C.

The x-ray diffractometer furnace and dilatometer were used to measure the thermal expansion of compositions in the solid solution system KCl - KBr. These results were also the same within an experimental error of 2%. The solid solution systems KBr - RbBr, RbBr - RbCl, and RbCl - KCl were measured by the x-ray method. The coefficients were found to be a non-linear function of composition.

A theoretical explanation based upon the Grueneisen equation of state is suggested which involves an interaction energy between unlike members of the solid solution.

The theoretical coefficients of thermal expansion were computed using PENNSTAC, a high speed digital computer, by a method described by Fletcher (1957). The theoretical coefficients do not have the same temperature dependency as those experimentally measured. By allowing the Grueneisen constant to increase with temperature, a reasonable agreement is obtained.

Microfilm \$2.95; Xerox \$10.35. 228 pages.

SOME MECHANISM STUDIES OF NUCLEOPHILIC SUBSTITUTIONS AT SILICON

(L. C. Card No. Mic 61-58)

Martin Charles Musolf, Ph.D.
The Pennsylvania State University, 1960

In this thesis is reported a study of the mechanism of the hydrolysis of monofluorosilanes. The results of this study indicate that the hydrolysis is an equilibrium reaction and that it is both acid and base catalyzed. The rate of hydrolysis has been shown to be retarded by steric hindrance about the central silicon atom and facilitated by electron-withdrawing groups attached to the silicon reaction center. The data presented are consistent with two

basic mechanisms. First, a mechanism analogous to the carbon S_N2 mechanism differing only in the additional possibility that silicon can be attacked at angles of 90°, 120° or 180° to the leaving group where carbon is restricted to 180° attack by this mechanism. Second, a mechanism in which the entering group, water, attacks silicon in a rate-determining step to form a pentacovalent silicon intermediate which in turn decomposes to products in a fast process.

A study of the reduction of chloro-, fluoro- and methoxy-silanes with lithium aluminium hydride is also reported. This study involved competing optically active functional silanes with optically inactive functional silanes for an insufficient amount of lithium aluminium hydride. The extent of reduction of the optically active and inactive compounds was determined by means of a polarimeter. This method has shown itself to be a unique and useful method for studying rapid organo-silicon reactions. From this study it was shown that these reductions were affected in the same manner by changes in the structure of the silicon substrate, that is, electron-withdrawing groups attached to silicon increased the rate of reduction and steric hindrance about silicon decreased rate. Important data are presented which indicate that the steric course of the reduction of chloro- and fluoro-silanes can be reversed by changing the structure about the central silicon atom with no apparent adverse effects upon the rate of reduction. It was concluded from these data that the energy barrier between an invertive and retentive mechanism must be quite small.

Microfilm \$2.75; Xerox \$6.80. 142 pages.

THE HEAT CAPACITIES OF IRON (II) CHLORIDE AND IRON (II) IODIDE

(L. C. Card No. Mic 60-5976)

Franklin Lee Oetting, Ph.D.
University of Washington, 1960

Chairman: Norman W. Gregory

A high temperature adiabatic calorimeter has been constructed which is suitable for measurement of the specific heats of corrosive, reactive, and easily oxidizable materials in a temperature range from 70° to 500° C. The performance of the calorimeter has been tested using alpha aluminum oxide with a maximum deviation of about 2% and an average deviation of 0.53% compared to the most recent data given in the literature for that substance.

The heat capacities of the two crystal forms of iron (II) chloride have been measured from 70° to 500° C, with an average deviation from the smoothed curve of 0.91%. No difference was observed, within experimental error, between the heat capacity of the cubic close-packed structure and the random-packed structure in the temperature range 70° to 500° C. The heat capacity of iron (II) chloride determined from this work agreed favorably with the work of Moore¹ but not with that of Krestovnikov and Karetnikov.²

The heat capacity of the hexagonal close-packed structure of iron (II) iodide was measured. The random-packed form could not be prepared by the same method used for iron (II) chloride. An anomaly was observed in

the heat capacity curve for iron (II) iodide, beginning at 360° C and extending over a temperature range of twenty-five degrees. The anomaly is believed to be a second order transition although the cause has not been determined.

X-ray powder patterns indicated that no structural change accompanied the transition.

Evidence suggesting non-stoichiometry of iron (II) iodide has been observed.

Equations for the heat capacity, relative enthalpy, and relative entropy for iron (II) chloride and iron (II) iodide are:

FeCl_2 (343° - 773° K)

$$C_p = 18.94 + 2.03 \times 10^{-3} T - 1.17 \times 10^5 T^{-2}$$

$$H^\circ_T - H^\circ_{298.16} = 18.94T + 1.015 \times 10^{-3} T^2 + 1.17 \times 10^5 T^{-1} - 6,130$$

$$S^\circ_T - S^\circ_{298.16} = 43.62 \log T + 2.03 \times 10^{-3} T + 0.585 \times 10^5 T^{-2} - 109.2$$

FeI_2 (343° - 633° K)

$$C_p = 19.83 + 5.833 \times 10^{-4} T$$

$$H^\circ - H^\circ_{298.16} = 19.83T + 2.917 \times 10^{-4} T^2 - 5,935$$

$$S^\circ - S^\circ_{298.16} = 43.67 \log T + 5.833 \times 10^{-4} T - 108.2$$

Microfilm \$2.75; Xerox \$4.00. 74 pages.

KINETICS OF THE REACTION OF AMMONIA AND NITRIC OXIDE IN THE REGION OF IGNITION

(L. C. Card No. Mic 60-6084)

Donald Ray Poole, Ph.D.
University of Oregon, 1961

Adviser: W. M. Graven

The gas phase oxidation of ammonia by nitric oxide has been studied between the temperatures of 850° and 1050°C. A flow system was used and the products were examined qualitatively by gas chromatography. The major products of the reaction are nitrogen and water, but undetermined amounts of hydrogen are also produced. The rate of the reaction was followed by sorption of the water from the effluent gas stream on ascarite.

The reaction rate was found to be proportional to the two-thirds power of the ammonia concentration. In addition, the order of the reaction with respect to the nitric oxide concentration was shown to be approximately 1.1. The empirical rate equation

$$\frac{d(\text{H}_2\text{O})}{dt} = \frac{k_1 (\text{NH}_3)^{\frac{1}{2}} (\text{NO})}{1 - k_2 (\text{NH}_3)^{\frac{1}{2}} (\text{NO})}$$

adequately represents the rate of the reaction.

The two parameters, k_1 and k_2 , were evaluated by a graphical method. From the temperature dependence of

k_1 an activation energy of 58.4 kcal. was calculated. The rate constant k_1 is given by the equation

$$k_1 = 3.2 \times 10^{10} \exp(-58,400/RT) \text{ (mmoles/l.)}^{-\frac{1}{2}} \text{sec.}^{-1}.$$

Since k_2 is a small temperature dependent parameter the rate equation predicts a transition from a steady rate to an explosion when $k_2 (\text{NH}_3)^{\frac{1}{2}} (\text{NO}) \approx 1$. This prediction was confirmed and explosions were observed at temperatures as low as 960°C. The effects of temperature and concentrations of reactants on the explosion limits were determined. The temperature dependence of the explosion limits permitted the determination of an activation energy of 30 kcal. for k_2 .

Certain processes which may contribute to the mechanism of the reaction have been discussed.

Microfilm \$2.75; Xerox \$3.80. 69 pages.

THE CHEMICAL EFFECTS OF NEUTRON CAPTURE IN *cis*- AND *trans*-DICHLOROBIS-(ETHYLENEDIAMINE)-COBALT(III) NITRATE

(L. C. Card No. Mic 61-257)

Herbert Edson Rauscher, Ph.D.
Columbia University, 1960

The kinetics of the isothermal annealing of Co^{60} (5.3 y) and Cl^{38} (37.5 min) recoil species in *cis*- and *trans*- $[\text{Co}(\text{en})_2\text{Cl}_2]\text{NO}_3$ have been investigated. After a given isomer was irradiated, neither Co^{60} nor Cl^{38} was found in any appreciable amount in the other isomeric form, nor did any appear as the other isomer upon annealing. Average energies of activation of 5 kcal/mole and 6.5 kcal/mole were found for the Co^{60} and the Cl^{38} annealing process, respectively, which correspond to entropies of activation of -61 cal/deg/mole and -56 cal/deg/mole. The increase in the retention of Co^{60} and Cl^{38} is described in terms of competitive reactions in the recoil sites. The increase in the retention due to isothermal-annealing processes occurring during the lifetime of the hot zone was estimated, and was found to be negligible.

Microfilm \$2.75; Xerox \$3.60. 63 pages.

ADSORPTION OF HELIUM ON A PREPARED SURFACE BETWEEN 4.2°K. AND 20°K.

(L. C. Card No. Mic 61-64)

Marvin Ross, Ph.D.
The Pennsylvania State University, 1960

It is well known that when the Brunauer, Emmett, and Teller theory of multilayer adsorption is applied to a helium adsorption isotherm that a monolayer volume is obtained which is from two to four times the volume predicted from a knowledge of the surface area and the assumption that adsorbed helium is liquid packed. In this investigation, a direct determination was made of the densities and the adsorption energies of the first few layers. These properties were determined by measuring

the heats of adsorption of helium on a uniform surface and allowing the sharp drop offs in the heats at the end of a layer to indicate the surface densities.

An apparatus was constructed and used to measure the heats of adsorption, heat capacities and isotherms of helium adsorbed on an argon covered TiO_2 surface between 4°K . and 20°K . From the shape of the heat of adsorption curve, it was concluded that the density of the first adsorbed layer was about twice that of the liquid and two-thirds of the value predicted from a B.E.T. analysis. The B.E.T. theory was criticized with regard to its application to adsorbed helium and an appropriately modified version of this theory was found to be more adequate. The Frenkel-Halsey-Hill equation was slightly modified and the modified equation accurately predicted the heats of adsorption and surface layer densities from the shape of the isotherm.

Two theoretical treatments of the helium film density predicted results in good agreement with experiment. One of these theories is a two dimensional version of London's lattice theory of liquid helium and was used to determine the most stable state of an adsorbed helium film at 0°K . The other treatment predicts film densities from a knowledge of the surface perturbation energy and the compressibility of the unperturbed fluid.

The behavior of a monolayer of helium adsorbed on an argon surface was considered. Equations were derived for the calculation of the barriers to lateral mobility and for the second virial coefficient for helium atoms on a uniform surface.

Microfilm \$2.75; Xerox \$7.00. 146 pages.

SOME PHYSICAL PROPERTIES OF RARE-EARTH CHLORIDES IN AQUEOUS SOLUTION

(L. C. Card No. Mic 61-471)

Victor William Saeger, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Dr. F. H. Spedding

The aqueous solution behavior of some rare-earth chlorides was investigated at 25°C . in the concentration range between 0.02 molal and saturation. Density measurements on solutions of lanthanum, neodymium, samarium, gadolinium, dysprosium, erbium, and ytterbium chlorides were carried out by a pycnometric method with an estimated accuracy of 1×10^{-5} gm. per ml. From the density data the apparent molal volumes for these rare-earth chlorides were calculated. The apparent molal volume data for each rare-earth chloride were expressed as a function of the square root of the molality by a five-parameter power series from which partial molal volumes were calculated. Conductance measurements on solutions of these rare-earth chlorides were carried out over the same concentration range using the conventional alternating-current technique. In addition, the solubilities of the rare-earth chlorides at 25°C . were determined.

Osmotic and activity coefficient determinations for solutions of lanthanum, neodymium, samarium, gadolinium, and dysprosium chlorides were carried out in the concentration range between 0.1 molal and saturation by the

isopiestic comparison method using potassium chloride and calcium chloride reference solutions. The solubilities of these salts at 25°C . were also determined by an adaptation of the isopiestic method.

The apparent and partial molal volumes of the rare-earth chlorides at a given concentration do not show a regular decrease with increasing atomic number of the rare-earth as might be expected from the decreasing ionic radius. This irregular order can be explained qualitatively on the basis of a change in the water coordination number for the rare-earth ion occurring in the middle of the rare-earth series.

The specific and equivalent conductances at a given concentration were found to decrease with increasing atomic number of the rare earth except for the reversal in position of lanthanum and neodymium chlorides. The general trend is in line with the expectation that the smallest ions will be the most heavily hydrated and thus have the lowest mobility. The change in the specific and equivalent conductances at a given concentration between adjacent rare-earth chlorides is much greater in the middle of the series than at either end. It is likely that this behavior together with the reversal in position of the lanthanum and neodymium chloride curves are related to the indicated change in coordination number, since such a change would undoubtedly alter the effective radius of the ions and hence their mobility.

The osmotic and activity coefficients for the rare-earth chlorides at a given concentration show a general increase with increasing atomic number of the rare-earth. The activity coefficient curves drop steeply from unity at infinite dilution, pass through a rather flat minimum between 0.2 and 0.6 molal, and then rise markedly with increasing concentration.

The solubility data for the rare-earth chlorides indicate that the solubility rises to a maximum for cerium or praseodymium chloride, reaches a minimum at europium chloride, and continues to increase for the heavier rare-earth chlorides. Microfilm \$2.75; Xerox \$9.45. 209 pages.

EFFECTS OF IRRADIATION AND THERMAL TREATMENT ON THE DIELECTRIC DISPERSIONS IN NYLON

(L. C. Card No. Mic 61-70)

Marvin Neal Stein, Ph.D.

The Pennsylvania State University, 1960

A study has been made of the relationship between the dielectric properties of polymers subjected to the alternating stress of an externally applied electric field as a function of temperature and frequency and the internal structure of these polymers as it is altered by irradiation, moisture content and thermal treatment. The dielectric constant and dielectric loss for various irradiated and non-irradiated samples were measured in the temperature range from -160°C to $+80^\circ\text{C}$ and for frequencies of 0.1, 1, 10 and 100 kc. The samples were in the form of thin films cut to a disk three inches in diameter which were placed between the electrodes of a parallel plate capacitor which comprised a vacuum sealed, shielded dielectric cell. The samples were vacuum desiccated to eliminate absorbed

moisture. The dielectric cell and irradiation cell were vacuum pumped to control moisture content and to limit oxidation.

In general, the dielectric data exhibit one or more dispersion regions which have been correlated with the onset of various modes of internal motion within the polymer. The temperature at which the maxima of the dispersions occur is found to be a function of the frequency and hence the observed phenomena can be associated with a relaxation process. From these data activation energies associated with the various molecular transitions have been computed and compare favorably with published data.

This work was primarily concerned with the dielectric properties of two polyamides, polyhexamethylene adipamide (Nylon 66) and polyhexamethylene sebacamide (Nylon 610), in the low temperature region where two broad secondary dielectric loss peaks have been found. These have been designated as the γ peak occurring at about -70°C and the β peak which appears in the region of -10°C . It was found that these two loss peaks were markedly effected by moisture content, radiation, and subsequent annealing.

Increase of water causes a decrease in the magnitude of the low temperature γ response and an increase in the magnitude of the higher β response. The variations in the response produced by absorbed water is believed to be due to the rupture of intermediate hydrogen bonds by water molecules, thereby allowing both greater rotational freedom of the amide group and a more closely packed structure as evidenced by increase in density. The breaking of the hydrogen bond reduces restraints hindered by the reorientational motion of the chain segments. Hence, the β dispersion, which is believed to be due to the presence of amide groups not hydrogen bonded to other amide groups, increases in magnitude. Simultaneously, the closer packing of the chain tends to restrict the motion of the CH_2 units and thus accounts for the observed decrease in the γ response.

Thermal quenching from 250°C produces an effect similar to the case discussed above, suggesting that this treatment also tends to destroy hydrogen bonding. However, annealing at the relatively low temperature of 80°C apparently restores the hydrogen bonds since the dielectric response reverts to that of a sample slowly cooled from the quenching temperature, and under these conditions one expects a maximum amount of hydrogen bonding.

Electron irradiation at relatively low dosages produces a large increase in the β response while at larger dosages the increase appears to be less. Here two competing processes are believed to be present. On one hand the irradiation is destroying hydrogen bonding and increasing the mobility of the amide groups. This is reflected in the increase in the β response. On the other hand, when the concentration of free radicals produced by the irradiation becomes great enough, conditions for cross-linking will become favorable and, especially after annealing, this process will tend to produce cross-links and a three-dimensional rigid structure which will restrict internal motion and hence reduce the dispersion maximum.

The similarity between thermal quenching and low dose irradiation suggests that irradiation damage is a thermal spike phenomenon where the region in proximity to the path of the bombarding particle is instantaneously heated to extremely high temperatures and then rapidly cooled. A quantitative analysis of this idea gives results of the proper order of magnitude to justify this hypothesis.

Microfilm \$2.75; Xerox \$6.20. 130 pages.

ROVIBRONIC ANALYSIS OF THE NEAR ULTRAVIOLET ABSORPTION SPECTRUM OF 1,2-DIAZINE.

(L. C. Card No. Mic 60-6152)

Wayne Coleman Tincher, Ph.D.
Vanderbilt University, 1960

Supervisor: Professor K. K. Innes

Most of the difficulty in accounting for the ultraviolet spectra of aromatic molecules arises from the large number of bands that occur in relatively narrow spectral regions. Measurements of low accuracy cannot lead to unique vibrational assignments of the bands. Yet, without such assignments, conclusions about electronic energies and molecular shapes are not possible. It would be worthwhile to measure very accurately at high spectral dispersion the band heads of aromatic molecules which show very sharp heads and to apply, as far as possible, the methods of confirming analyses used previously for molecules containing two to six atoms; for example, determination of rotational constants which depend on vibrational states and study of the effect of temperature on band intensities. The present study represents the first step in such a program for large molecules. Pyridazine was chosen because its bands are very sharp and showed much fine structure in preliminary high resolution photographs.

The spectrum of pyridazine vapor was photographed in the fourth order of a 3.4 meter spectrograph equipped with a 150,000 line plane grating. The actual resolution was over 200,000 and the dispersion of the order of 0.30 Å/mm. Absorbing path lengths of up to 16 meters were obtained using a multiple reflection mirror system. Over 700 vibrational band heads and the rotational fine structures in 8 bands were measured on a linear comparator. The rovibronic analysis proved straightforward and uniqueness of the main features of a rovibronic analysis has been achieved for the first time for a molecule containing more than five or six atoms.

The O-O band is a parallel type band at $26,648.75\text{ cm}^{-1}$. The inertial constant (\bar{B}) is 0.2034 and 0.2030 cm^{-1} in the lower and upper electronic states respectively.

Assignments have been given to the 140 strongest vibrational bands. Vibrational frequencies have been accurately determined for ν_{6a} (664.89 cm^{-1} in the lower state and 372.71 cm^{-1} in the upper state), ν_1 (969.81 cm^{-1} and 757.39 cm^{-1}), and ν_{6b} (624.89 cm^{-1} and 534.09 cm^{-1}). Somewhat less accurate determinations have been made of the other A_1 and B_1 ring and hydrogen bending frequencies. No out of plane bending modes (A_2 and B_2) appear with appreciable intensity. Only one electronic transition has been needed to reasonably explain the appearance of both red and blue degraded bands and parallel and hybrid type bands in the 3700 Å absorption.

The main conclusions are: a) Only one electronic state (of symmetry B_1) is needed to explain the 3700 Å bands. b) The molecule remains planar in the excited state but undergoes a considerable ring distortion which may result in a slight departure from its ground state symmetry. c) While the analysis is consistent with the present view that the absorption arises from excitation of a non-bonding nitrogen electron, surprisingly large reductions in vibrational frequencies are encountered.

Inertial constants determined from the analysis are not sufficient for a complete structure determination of either state, but, since no other structural information for the

molecule is available, a model consistent with the present data is proposed.

Microfilm \$2.75; Xerox \$5.20. 102 pages.

**PRESSURE-TEMPERATURE UNIVARIANT
EQUILIBRIA OF SOME REACTIONS IN THE
SYSTEM, CaO-MgO-SiO₂-CO₂.**

(L. C. Card No. Mic 61-73)

Louis Simon Walter, Ph.D.
The Pennsylvania State University, 1960

The pressure-temperature equilibria of some univariant reactions in the system CaO-MgO-SiO₂-CO₂ were investigated in order to provide data for the petrogenetic grid proposed by Bowen (1940) and thus to facilitate the study of the processes of metamorphism. The reactions are:

- (1) calcite + diopside + forsterite \rightleftharpoons monticellite + CO₂,
- (2) calcite + diopside \rightleftharpoons akermanite + CO₂,
- (3) calcite + forsterite + akermanite \rightleftharpoons monticellite + CO₂,
- (4) diopside + monticellite \rightleftharpoons forsterite + akermanite,
- (5) calcite + forsterite \rightleftharpoons monticellite + periclase + CO₂ and
- (6) spurrite + monticellite \rightleftharpoons merwinite + calcite.

P-T curves for (1), (2), (3) and (4) meet at a quaternary invariant point which is at 885°C. and 6000 p.s.i. CO₂. The univariant curves for (1) and (3) fall at temperatures below and above the invariant point respectively. Since reactions (2) and (3) are in ternary systems, curves for these reactions occur on both sides of the invariant point. The curves for (1), (2), (3) and (5) are so near together in pressure and temperature as to be experimentally indistinguishable. The "reaction zone" in which these curves occur passes through the points:

2500 p.s.i. CO₂ at 800°C.
6000 p.s.i. CO₂ at 885°C. and
10000 p.s.i. CO₂ at 925°C. .

The P-T curve of reaction (4) passes through the invariant point with a slope of 4°/1000 p.s.i. . The univariant curve for (6) originates at 820°C. at atmospheric pressure and has a slope of -0.7°C./1000 p.s.i. .

Natural occurrences of mineral assemblages which have been metamorphosed in this P-T range are reported, and the contact deposits at Crestmore, Calif. are reviewed in the light of experimentally determined univariant reactions.

Microfilm \$2.75; Xerox \$5.20. 104 pages.

**SOME PHYSICAL, CHEMICAL, AND THERMO-
HYDRODYNAMIC PARAMETERS OF EXPLOSIVE
AMMONIUM NITRATE-FUEL OIL MIXTURES.**

(L. C. Card No. Mic 60-6832)

Joseph John Yancik, Ph.D.
University of Missouri, 1960

Supervisor: Professor George B. Clark

The explosive properties of ammonium nitrate-fuel blasting agents were investigated by measuring their detonation velocity and sensitivity. Detonation velocity was measured by a pin oscillograph method with a modified pin technique. Five types of tests were used to evaluate the explosive sensitivity of AN-fuel mixtures under varied environmental conditions. These tests measured the confined and unconfined critical diameter, minimum primer for a three inch diameter iron pipe confined charge, for an unconfined charge at the critical diameter, and minimum primacord primer under special conditions.

Properties of ammonium nitrate-fuel blasting agents were evaluated by considering the effects which each component of a mixture has upon its explosive behavior. These test results showed that the detonation properties of AN-fuel mixtures are dependent upon the type of fuel and ammonium nitrate used in the mixture.

Explosive properties of regular prilled ammonium nitrate-fuel oil mixtures were found to be dependent upon: (1) preparation method and formulation, (2) charge shape and external charge environment, and (3) the physical condition of the prilled AN. The particle size, shape, and structure of AN particles used in a 94/6 AN-fuel oil mixture have a pronounced influence on the explosive properties. The porous structure of regular prilled AN was shown to be the primary reason for its higher mass reaction rate compared to other types of commercially manufactured AN. The mass reaction rate varied within limits in agreement with the theory of Eyring's grain surface burning model.

Investigation of the explosive properties of 33 dense micropilled AN products in a 94/6 AN-fuel oil mixture indicate that particle size distribution exerts a measurable amount of influence on detonation velocity and sensitivity. Advantages of dense micropilled AN over regular prilled AN for use in blasting agents are its pouring density of 1.10 grams per cubic centimeter and greater detonation velocity of approximately 4000 feet per second for similar charge conditions. The significant difference between the two AN products was that the 94/6 dense AN mixture behaved as an ideal explosive in steel confined charges greater than eight inches in diameter.

The ideal explosive parameters of AN-fuel oil mixtures were calculated by the thermohydrodynamic theory using the general method developed by Cook which was adapted for an IBM 704 computer. The basic mathematical problem was reduced to the solution of six simultaneous non-linear equations which were solved by a modified Newton-Raphson method. The set of non-linear equations was transformed into a set of linear equations and solved by a modified Gauss reduction.

Four theories of non-ideal detonation: the nozzle, curved front, variable reaction zone length, and geometrical model were applied to the observed explosive properties of eight AN-fuel oil mixtures in which the particle size and structure of the AN was varied. The geometrical model was shown to be the most useful for the prediction

of detonation velocities at varying charge diameters. The ideal reaction times given by the nozzle theory were three to five times those predicted by the curved front theory. The variable reaction zone length theory gave ideal reaction times 10 to 25 times greater than those of the curved front theory. The ideal reaction times given by the

geometrical model were 50 to 100 times those given by the curved front theory. Specific reaction rate constants computed by the geometrical model agreed within an order of magnitude of ten with the reaction constants given by the absolute reaction rate theory.

Microfilm \$3.85; Xerox \$13.50. 298 pages.

ECONOMICS

ECONOMICS, GENERAL

AN ECONOMIC ANALYSIS OF
TRADE UNION POWER

(L. C. Card No. Mic 61-98)

Ronald Edwin Carrier, Ph.D.
University of Illinois, 1960

The purpose of this thesis was to test certain hypotheses which have grown out of the literature on trade unionism. These hypotheses are: Trade unionism has caused "distortions" in the "natural" functioning of the economy. The "distortions," thus, are the basis for the hypotheses that trade unions cause an uneconomic allocation of resources, cost and price "distortions," leading to inflation and/or unemployment, a redistribution of income, and a retardation of economic growth.

In order to test the hypotheses, it was necessary to answer such questions as the following: What impact have trade unions had on occupational, interregional, inter-industry, and interpersonal wage differentials? Has the share of national income going to wages increased at the expense of profits and, if so, can this increase be attributed to trade unionism? What part have trade unions played in the post-World War II inflation? Has the economy experienced economic growth? If so, have trade unions stimulated or retarded this growth?

The ultimate objective of the thesis was to reach some conclusions as to appropriate public policy in this area of trade union activities.

The study of wage differentials did not substantiate the hypothesis that trade unions have "distorted" wages and caused an uneconomic distribution of resources--especially the human resource. Quite obviously, there are certain situations in which trade unions have caused wages to be different from what they would have been in an unorganized market, but the studies did not indicate that the differences can be solely attributed to union policy. Furthermore, the studies did not indicate that trade union wage policy has caused "wage distortion unemployment."

In addition, the study of distributive shares did not substantiate the hypothesis that trade unions have had a significant influence on the redistribution of the national income as a result of their economic activities. Unions, however, probably have had considerable influence on distributive shares as a result of their political activities. Unions have favored fiscal policies which have redistributed income. Furthermore, by pressing strongly for post-war full employment programs, even at the expense of some inflation, unions have helped to evolve policies that may have increased labor's relative income shares by preventing serious business slumps. However, trade

unions have enjoyed a broad base of middle-class support as well, which makes it difficult to assess the decisiveness of the union's political role.

The study of post-World War II inflation showed that trade unions were a contributory factor during this period. However, trade unions were aided by other powerful economic groups--oligopoly and government. These institutional arrangements prevent downward adjustment of wages and prices while exerting constant upward pressure on wages and prices which resulted in rising prices.

The study of economic growth--as indicated by real per capita income and output-per-man-hour--shows that our economy has experienced substantial growth since 1929. It was concluded that trade unions have not had an adverse impact on the components of economic growth--flexible and mobile labor supply, investment, managerial efficiency, and continuing innovations in production and work methods.

With respect to policy recommendations, the study concluded that further application of the antitrust laws to trade unions was unnecessary since almost all of the practices which were formerly unlawful under the antitrust laws have been outlawed by the Taft-Hartley and Labor Reform Acts. Likewise, it was concluded that banning industry-wide bargaining would not necessarily reduce the economic power of trade unions.

However, certain changes in our present national labor policy were recommended. New legislation should be enacted to eliminate the closed shop and certain union restrictions on managerial prerogatives. However, before inflation can be brought under effective control, basic changes will have to be made in our institutional arrangements which place continuous upward pressures on the price level. Microfilm \$2.75; Xerox \$8.60. 190 pages.

TRADE UNIONS' PRACTICES AND THE
NEGRO WORKER — THE ESTABLISHMENT
AND IMPLEMENTATION OF AFL-CIO
ANTI-DISCRIMINATION POLICY.

(L. C. Card No. Mic 60-6285)

N. F. Davis, Ph.D.
Indiana University, 1960

At its birth in 1955, the AFL-CIO inherited, among its problems, the problem of racial discrimination within organized labor. This problem of unions' discrimination against Negro workers has been persistent since the early years of the American labor movement. Historical and other scholarly writings on the subject of Negroes in the

labor movement reveal that a number of unions and federations of unions have sought to bring Negroes into the labor movement without discrimination, and, largely through education, have urged the elimination of racial discrimination by unions. However, while there were experiences of measurable success in reducing racial discrimination by some unions, many unions made no noticeable attempts toward reducing racial discrimination within their ranks. It appears that practices of unions' discrimination against Negro workers, rationalized by the Negro's previous condition of servitude and the idea of racial inferiority associated with it, developed firm roots over the years.

As a demonstration of concern about the problem of racial discrimination within organized labor, the founders of the AFL-CIO, prior to the merger, discussed civil rights as a primary objective of the new federation. Hence, when the new organization was formed the AFL-CIO constitution not only established a firm anti-discrimination policy, but charged the Executive Council with the responsibility to implement the policy, and directed that the AFL-CIO President appoint a civil rights committee to assist the Council.

The Civil Rights Committee assisted by a staff, the Civil Rights Department, has, since its creation, handled numerous cases alleging racial discrimination by labor unions. The work of the Committee has been aided by the cooperation of other anti-discrimination units including those of affiliated unions, government, and private organizations.

In spite of its firm anti-discrimination policy and success in resolving many cases alleging racial discrimination, the AFL-CIO has not experienced the success apparently hoped for by its founders. Many unions have failed to support actively the federation's anti-discrimination program. Some unions have openly practiced discrimination against Negro workers in defiance of the federation's anti-discrimination policy; and a few have defied AFL-CIO orders that they discontinue certain alleged practices of racial discrimination. Those unions which have been named most frequently as being guilty of racial discrimination possess long histories of racial discrimination.

On the other hand, a number of affiliated unions have established anti-discrimination programs with fairly effective implementation machinery. It appears, however, that although these unions have had measurable success in the anti-discrimination area with industrial affiliated locals, the elimination of discrimination by craft affiliated locals has been successful only to a very limited degree.

Although the practice of racial discrimination via constitutional and other obvious means have diminished considerably, they have been replaced somewhat covertly. Credit for eliminating the more obvious kinds of discrimination, however, must be collectively shared by the AFL-CIO, the courts and the NLRB.

Since those unions which were progressive in the area of civil rights prior to the merger have continued to make progress in the area, the AFL-CIO may well have to concentrate on those unions which made little (if any) progress prior to the merger and which have not shown a significant change since the federation's anti-discrimination policy was established. Otherwise, continued racial discrimination by unions may lead to further involvements by government and the courts into the affairs of labor unions.

Microfilm \$3.10; Xerox \$10.80. 237 pages.

UNITED STATES FOREIGN OIL INVESTMENTS AND UNITED STATES DOMESTIC ECONOMIC POLICY

(L. C. Card No. Mic 60-6081)

A. George Gols, Ph.D.
University of Oregon, 1961

Adviser: Raymond F. Mikesell

Statement of the Problem

During the postwar period the United States Government has encouraged the flow of private capital for foreign petroleum investments. Such investments were considered desirable, (1) for developing the Free World's fuel supplies, and (2) for promoting the exports and economic growth of developing countries.

On the other hand, the Government has in recent years restricted the volume of oil imports in order to maintain a level of domestic production and exploration activity which, in times of national emergency, would ensure supplies sufficient to meet internal requirements.

This study analyzes the relationship between United States foreign oil investments and investment policy, and imports and import policy. It seeks to determine: (1) Whether the expansion of foreign oil investment has been the primary cause for the growth of United States oil imports; (2) whether United States foreign oil investments and oil import restrictions are compatible; (3) whether national security interests require a continued expansion of foreign oil investment and imports, and (4) what oil investment and import policies should be adopted in the future.

Method of Data Collection

The data used are based primarily on published information obtained from either domestic or foreign Government and private sources. Some information is based on private conversations and correspondence with officials of the Government and private firms, as well as on the writer's previous research experience in the field of petroleum economics.

Summary of Major Findings

The conclusions derived from this study are:

- (1) A continued flow of United States oil investment to foreign areas is of strategic and economic importance to the United States, its Allies, and the Free World as a whole.
- (2) The principal motivation for United States foreign oil investment has been the desire to participate in foreign petroleum markets. A secondary motivation has been to supply domestic requirements.
- (3) The primary cause of expanded oil imports into the United States has been the high cost of finding, developing and producing oil at home relative to the costs abroad.
- (4) In the absence of import restrictions, United States oil imports are expected to equal 35 to 40 per cent of production by 1975.
- (5) Present United States import and foreign investment policies are incompatible.

(6) The probable nature of future warfare would not seem to warrant an attempt to achieve self-sufficiency.

(7) If self-sufficiency is required, it is best secured by conserving high-cost domestic reserves and importing less expensive foreign oils.

(8) If self-sufficiency goals are not warranted, United States national security interests are best served by a wide geographic dispersion of foreign petroleum investments and foreign oil-supply sources.

(9) Foreign oil investments on a non-concessionary basis should be encouraged, and there should be a greater emphasis on expanding foreign investment in oil processing activities such as refining and the production of petrochemicals.

(10) The greatest future challenge to the American petroleum industry lies not in the possibility of a domestic emergency situation, but in being able to adapt to the changing competitive conditions in the foreign oil producing countries.

Microfilm \$2.75; Xerox \$8.60. 188 pages.

AN APPLICATION OF INVENTORY THEORY TO FARM EQUIPMENT REPAIR PARTS

(L. C. Card Mic No. 61-451)

James Gardner Hilton, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Dr. Gerhard Tintner

The main object of the analysis was to determine optimal procurement quantities and reorder points for a sample of farm equipment repair parts at minimum cost given some specified service to warehouses, dealers, and farmers. A farm equipment company was studied which produces repair parts for its own products. Policies were derived for a few repair items at the factory warehouse level.

An autoregressive scheme was developed to predict annual demand and was incorporated into a mathematical model developed by Beckmann and Muth. Various methods of estimating parameters of the model are described in detail along with the limitations of these estimates. The problem is not only one of illustrating the operation of such a method, but includes an analysis as to the practicability of applying the optimal policy system to a farm equipment factory on a large scale basis.

Set-up costs, reorder costs, unit costs, storage costs, and shortage costs were all estimated in detail for a sample of 45 repair parts. An IBM 650 computer was used to calculate optimal reorder points and procurement quantities for several of the repair items. In some cases shortage costs were varied to see the effect of these costs on stock-out probabilities, the reorder points, and the procurement quantities. Detailed studies were made on one repair part to analyze the effects of varying one parameter while all the others were held constant. The results showed that most of the parameters had critical ranges in which slight changes in the parameters resulted in large changes in the solutions. It was seen that fixing a probability of stock-out is essentially identical to setting a shortage cost.

Short-cut methods for both the calculation of reorder points and procurement quantities and the estimation of

parameters were developed in order that the complete method might be applied to a large number of repair items on a practical basis. Computing reorder points and procurement quantities with large demands even on a large computer was found to be too expensive. Unfortunately the model was so sensitive to slight changes that modifications made to reduce the computing time resulted in inaccurate results. One other major disadvantage was the necessity of selecting the difficult-to-estimate shortage cost instead of the easier probability of stock-out.

Since the optimal policies that were computed were definitely different from the policies presently used, it was recommended that further investigation be undertaken to develop a model that would be practicable.

Microfilm \$2.75; Xerox \$6.40. 133 pages.

THE PROBLEMS OF EFFECTIVENESS OF MONETARY POLICY

(L. C. Card No. Mic 60-6451)

Kap-Kyung Seo, Ph.D.

University of Cincinnati, 1960

Monetary policy has staged a remarkable comeback in the United States since the Treasury-Federal Reserve Accord of 1951. The revival of monetary policy has two aspects - the one political, the other theoretical.

Politically speaking, recent years have shown that a Republican administration clearly prefers the "conservative" methods. Monetary policy is indirect in its operation; its consequences are general and widespread. A "general" effect is a major advantage from the standpoint of appropriateness in a free society. On the theoretical side, the official view among Federal Reserve authorities seems to be that whatever its limitations in periods of depressed demand, monetary policy can be quite effective in curtailing total effective demand.

However, the irrefutable fact of the period 1950 - 1959 which the American economy suffered, namely a chronic, creeping inflation, throws a shadow of doubt concerning the effectiveness of monetary policy.

The so-called exponents of the cost-push inflation thesis devote their attention to the subject of an institutional change in our price system, i.e., a shift from "passive" to "administered" prices, and they developed the theory that in the latter price system the pricing process is impervious to monetary policy.

After an empirical analysis of the financial events of the period in question (Part II), the stage was set for a detailed presentation and critical evaluation of the variance of the cost-push theorem of inflation which, of course, is an intellectual outgrowth of this modern trend "administered" prices. Our presentation shows unqualified, qualified, and what may be called "quasi" versions of the cost-push inflation thesis. The difference between the unqualified and qualified versions centers around different assumptions concerning the slope of the demand for labor function, i.e., whether it is elastic or inelastic with respect to changes in the general level of money wage-rates.

Among trained economists it is realized that a wage push cannot generate inflation without a commensurate increase in total effective demand and that the latter

process involves either an increase in the quantity or velocity of money, or both. A tight money policy would prevent an increase in the quantity of money, so that inflationary developments would have to get their momentum merely from an increase in velocity. Many proponents of the cost-push thesis argue that a restrictive monetary policy is bound to be ineffective because of the more or less "automatic" offsetting role which velocity plays during periods of restrictive money supply. The involved velocity changes are viewed as a result of changes in the level of interest rates, in the sense of a diminution of the public's demand for liquid balances in times of rising interest rates, and a corresponding increase in such demand when rates are falling.

However, it must be emphasized that a reduced desire for liquid balances is not synonymous with increased velocity. Loanable funds must find users before they become effective demand for goods and services. Therefore, the motive of money owners to reduce their liquid balances must meet a motive of business firms to avail themselves of these balances for investment purposes, in order to translate itself into a velocity increase. This velocity increase is by no means an automatic result of tight-money policy and the resultant "rise in interest rate -- reduction in liquidity" mechanism. Whether it materializes depends on expectations operating on the demand side, and hence on discretionary elements.

The experiences of the fifties have also proved that employment and output are more sensitive to monetary stringency than are wages and prices and that - because of the intense economic and political concern over unemployment - the monetary authorities appear to have a perfectly sound reason to show moderation in the use of their controls. However, before condemning tight-money policy on these practical grounds one should prove that other methods are superior - not merely on theoretical but practical grounds.

The suggested intervention of government in wage negotiations is theoretically persuasive, but it can not be considered a practical substitute for restrictive money policy. If for political reasons the central bank can not afford fully to exploit the potentialities inherent in tight-money policy, why should "voluntarism" be expected to work? Microfilm \$2.75; Xerox \$7.60. 164 pages.

THE SCALE OF SOVIET INDUSTRIAL
ESTABLISHMENT, 1928-1958: A STUDY IN
THE THEORY AND PRACTICE
OF ECONOMIC PLANNING.

(L. C. Card No. Mic 60-5110)

Leon Smolinski, Ph.D.
Columbia University, 1960

This essay examines the theory and practice of Soviet economic planning in an important but little explored field: the choice of the scale of industrial plant. It describes policies followed by the Soviet planners and suggests some underlying factors. Changes in the scale of plant over time are examined for selected industries, frequency distributions of plants by size and data on the scale of new projects are presented. The relationship is

studied between the scale of plant and various aspects of its performance such as costs and physical production coefficients.

The average scale of Soviet industrial establishment, measured by physical output, was found to have increased very considerably under the Five-Year Plans in virtually all of the more than forty industries for which information could be secured. The percentage increase tended to be the highest in various branches of heavy industry and in those consumer goods industries in which newly built plants accounted for a large share of output. Comparisons were made with the scale of plant in Tsarist Russia as well as with the scale of American industrial establishments at various points of time. It was found that the Russians have often been successful in the attainment of their avowed objective "to catch up with and to surpass" the scale of the American establishments, especially in high priority industries.

The objective in question was an important moving force in Soviet "giantism" of the early 'thirties which was characterized by an indiscriminate preference for construction of very large, whenever possible "the world's largest" projects, often patterned after the scale of the largest American establishments. Little attention was paid to elasticities of factor supply and to relative scarcities generally even though these differed considerably as between the USSR and the USA. The adverse effect of giantism on the length of gestation period and on transport inputs was largely ignored. Sensational economies of scale were anticipated, but our case studies suggest that they failed to materialize. On the contrary, giantism tended to aggravate the existing bottlenecks, to reduce the effectiveness of investment and to slow down the rate of growth. A partial recognition of these diseconomies of scale led, in 1938, to a reversal of policies and to launching "the fight against gigantomania." The planners' preference for very large projects was revived in the mid-fifties. Such projects are likely to be more successful now than in the primitive, bottleneck-ridden economy of the early Five-Year Plans. Our findings on the relationship between the scale of plant and various production coefficients indicate that the optimum scale of plant is now larger and that some of the previously existing diseconomies of scale were alleviated.

Three factors played a major role in determining Soviet policies with respect to the scale of plant: Marxian economic doctrine, with its emphasis on the importance of increasing returns to scale; a one-sided imitation of the US practices; and the desire to reduce the number of production units so as to facilitate planning and control. Soviet thinking on the subject is at present more balanced and more pragmatic than in the initial stage of Soviet industrialization. The insight seems to gain currency that local conditions, in particular raw materials base, transportation facilities, and density of demand justify construction of plants of widely differing sizes. This approach contrasts favorably with the early dogmatic solutions and may be considered a symptom of the more general drive which is nowadays observable in the USSR, toward a new economic rationality.

Microfilm \$6.95; Xerox \$24.75. 547 pages.

ECONOMICS, AGRICULTURAL

THE RESPONSE OF MILK PRODUCTION
TO PRICE: A REGIONAL ANALYSIS.

(L. C. Card No. Mic 61-436)

Randolph Barker, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Earl O. Heady

This research dealt with a regional analysis of supply response for milk. Past work in supply analysis, with but few exceptions, has focused upon the individual farm unit or upon the United States as a whole. This study was designed to bridge the gap between these extremes by providing regional estimates of supply response using regression techniques.

The hypotheses tested concerned differences in supply elasticities with respect to milk price for: (1) different geographical regions, (2) different time periods, and (3) different economic conditions. Regression analysis of time series was conducted for three of the major milk producing regions: the Lake States, the Northeast, and California. A less extensive investigation was made of the elasticity of supply for the United States as a whole. Two time periods were considered, 1926-58 and 1947-58. The hypothesis that the elasticity of supply is greater under rising than under falling prices was tested by grouping years according to milk-feed price movements in the long and the short run.

Variables used in addition to trend and the milk price were principally prices of competing products and costs of in-puts. These differed according to the region analyzed. Emphasis was placed upon single equations although elasticities were also computed for a two equation recursive system. Three basic forms of the single equation were employed: (1) a traditional model, (2) a distributed lags model, and (3) an irreversible model. In all three instances milk production was the dependent variable.

The recursive model was developed using cow numbers and production per cow alternately as the dependent variable. The recursive relationship is based upon the fact that the number of cows, which is a function of predetermined variables, is inversely related to the current year's production per cow.

The analysis for the Lake States indicates that the short-run elasticity of supply is between .30 and .35 for both time periods (1926-58 and 1947-58). Farm response to a change in the feed price was stronger than in the other two regions reflecting the comparatively wide alternative uses for feed grain. The elasticity of supply for the Northeast appears to be between .15 and .20 for the 1926-58 period, but has risen by approximately fifty percent in the postwar period. The low elasticity of response in this as compared with other regions is due to the fact that dairy farming has enjoyed a strong competitive advantage. The elasticity of response for California appears to be between .25 and .30 for the 1926-58 period. However, as in the Northeast, the elasticity in the postwar period shows a marked increase. Most estimates fell close to .40. The increase in the postwar elasticity may be due in part to the fact that fluid producers have experienced a greater certainty of price expectation under

administered pricing. Greater technological efficiency and extended knowledge also may have been contributing factors. Elasticities obtained for the United States compared closely with those for the Lake States.

Microfilm \$3.10; Xerox \$10.80. 238 pages.

AN ANALYSIS OF LIVESTOCK MARKETING
PATTERNS IN MISSOURI

(L. C. Card No. Mic 60-6781)

Durward Brewer, Ph.D.

University of Missouri, 1960

Supervisor: Dr. Elmer R. Kiehl

Changes have taken place which have had substantial impacts upon the livestock industry. The purposes of this dissertation were to (1) trace the development of livestock marketing in Missouri and to ascertain the economic conditions responsible for shifts in the total volume of production and marketings of meat animals sold, and to determine the relative importance of the various marketing agencies used by farmers when selling and purchasing livestock; (2) determine the types and availability of markets and marketing agencies which farmers utilized in buying and selling livestock, and the status of different markets in the total market structure; (3) point out some of the principal problems posed by existing marketing practices and conditions.

Information which formed the basis for the study was obtained from a random sample of 621 livestock producers in 30 sample counties. The counties which had similar characteristics in livestock production and marketing were segregated into seven homogeneous marketing areas. This procedure was accomplished by use of inventory numbers of livestock, sales by species, number of farms, average size of farm, market structure within the county, and other factors lending toward homogeneity. Data were then analyzed on aggregate state and area basis.

Data were collected from farmers on type of livestock produced, different markets used when selling and purchasing various classes and species of livestock, time of marketing major and secondary lots of animals, method of sale, method of transportation employed, sources of livestock market news and information, changes which had occurred in market outlets used for both buying and selling, and other relative data.

In addition to the farmer survey, 170 random questionnaires were taken on four types of livestock markets, (auctions, country dealers, local markets, packing plants), in order to obtain data on volume handled by class and species, functions performed, facilities and disposition of receipts.

In 1956, the total estimated number of cattle and calves sold by farmers was 2,337,900 head; hogs and pigs, 6,652,756; and sheep and lambs, 764,926 head. By use, these marketings for cattle and calves were slaughter, 57 per cent; feeders, 25 per cent; dairy and breeding, 4 per cent; and unknown, 14 per cent. Approximately 83 per cent of all hog sales and more than 91 per cent of all sheep and lamb sales were for slaughter use.

Variations existed among areas of the state in the species and classes of livestock sold by farmers as well

as variations among markets and their importance in relation to different classes of livestock sold. Terminal public markets were the major outlets used for the sale of slaughter animals. Auction markets were the most important feeder outlet. Livestock for breeding purposes were primarily sold direct to other producers.

The principal sources of market news used by farmers were radio, television, newspapers and farm magazines which primarily reported terminal market price and receipt data. Less than 2 per cent of the farmers received market reports on interior livestock markets.

Market outlets chosen by farmers varied by class of livestock sold or purchased. Frequent reasons given by farmers for using a particular market were higher monetary return, competition and convenience.

Terminal markets as an outlet as well as a source of feeder livestock has declined substantially. Farmers' cooperatives have declined in volume. Slaughter livestock sold to country dealers have declined to less than 3 per cent of aggregate marketings. Auction markets have shown a pronounced gain in volume handled. Direct sales of slaughter hogs to packers have increased substantially.

Microfilm \$4.35; Xerox \$15.30. 340 pages.

APPRAISAL OF AN ECONOMIC MODEL FOR USE IN ESTIMATING FARM OUTPUT RESPONSE

(L. C. Card No. Mic 61-39)

George R. Futhey, Ph.D.
The Pennsylvania State University, 1960

Accurate information concerning output response of agricultural commodities is needed to facilitate public debate and the making of agricultural policy. Although this thesis does not provide a means to predict output response in the aggregate, it is an attempt to develop a model to measure output response of an individual farm firm. It is hoped that from this effort, and others like it, information may be gained by which the aggregative output response of an agricultural product may be made.

The objective of this study is to develop and test a model which will measure output response of milk to changing economic variables, such as (1) relative prices of commodities which can be produced on the farm, (2) technology, (3) relative prices of inputs, (4) opportunity costs of fixed factors, including the farm operator's and/or family labor, and (5) time preference and income needs of the farm family.

After reviewing the literature the decision was made to use linear programming in testing the output response. A farm was selected to empirically test the output model. Changes in economic and technological conditions are hypothesized. To analyze the output response as a result of changes in the relative prices of commodities which can be produced on the farm, milk prices are allowed to vary from a price low enough to prohibit the production of milk to a price high enough to cause complete specialization in dairying. Output response of milk (and other commodities) over the range of the prices can then be measured. The changes in the relative prices of inputs are handled in a similar manner.

To measure output as a result of technology three levels of dairy chore labor efficiency are analyzed. This analysis includes the opportunity costs of the capital investment necessary to achieve different levels of labor efficiency.

Three different labor supply situations are analyzed to determine the opportunity costs of labor. From the results of the analysis of opportunity costs of labor and capital judgements can be made concerning the time preference and income needs of a farm family.

The changes in output and organization of the farm will be indicated by the solutions obtained from the use of the model. These results are used to answer the questions raised in the objectives of this study and evaluated against other evidences as to their reasonableness.

The model gives a specialized dairy operation when milk price is about \$3.50 per hundredweight. Such enterprises as swine, beef, and sheep do not appear in the farm organization as long as dairy is present. Poultry is in the farm organization initially, but is replaced entirely by a specialized dairy operation as the price of milk advances. When no milk is produced, the land resource is utilized in the production of crops for sale. As milk production enters the farm organization, the land resource is utilized in the production of forages. The returns to additional investment associated with technological innovations and additional inputs of labor are positively related to the price of milk. In general the rate of return falls between five and 20 per cent and is relatively stable.

The empirical results of the analysis of the farm in question by the model developed for the study are consistent, with a few exceptions, with the farm organizations that are commonly found in this area of Pennsylvania. Agricultural economists in the past have made the claim that the supply of milk is inelastic to price. The results of this study indicate such.

Although the author believes the results of this work are encouraging further work will be necessary before the important problems of aggregation of the industry supply functions can be made. However, he believes linear programming offers a relatively efficient method whereby farm enterprises may be analyzed in response to changing economic conditions.

Microfilm \$2.75; Xerox \$8.00. 174 pages.

EFFECTS OF CHANGES IN TRANSPORTATION COSTS ON THE LOCATION OF THE MEAT PACKING INDUSTRY

(L. C. Card No. Mic 61-458)

William Calvin Motes, Ph.D.
Iowa State University of Science and Technology, 1960

Supervisor: Geoffrey S. Shepherd

The objective of this study is to evaluate the impact of changes in transportation costs on the location of the meat packing industry. Examination of the history of location decisions in the meat packing industry revealed some likelihood that transportation costs, among other factors, may have influenced past changes in location. Moreover, examination of the theoretical decision-making framework

of the meat packing industry disclosed possible situations in which transportation costs could be expected to be significant location factors.

Transportation cost changes from value-of-service rates to cost-of-service rates were evaluated under four sets of assumptions by use of a series of theoretical models incorporating empirical data: (1) that value-of-service rates would remain in effect between 1954 and 1965; (2) that cost-of-service rates would be in effect during this period; (3) that value-of-service rates would be in effect between 1954 and 1965 and that regional livestock slaughter would locate where it would minimize total transportation cost; (4) that cost-of-service rates would be in effect and that regional livestock slaughter would locate where it would minimize total transportation cost.

For each separate set of assumptions a spatial price equilibrium model was solved for the livestock-meat economy of the United States. Each model yielded an optimum pattern of product flows for four species of livestock and four types of meats. The demands for fresh meats were considered to be interdependent so that at any given price one fresh meat would substitute for another at some specified rate.

The optimum solutions of these models showed that the change from value-of-service transportation costs to cost-of-service transportation costs was not associated with significant changes in industry location during a one-year period, but that this change was associated with significant location shifts over an 11-year period and that these changes became highly significant when livestock slaughter was allowed to locate immediately so that total transportation costs were minimized.

Thus, in spite of the fact that observers closely associated with the meat packing industry have indicated that the overwhelming importance of at least two cost categories -- cost of livestock and cost of labor -- reduces transportation costs to insignificance with regard to location decisions, on the basis of the results of this study it is concluded that changes in transportation costs can be expected to have a definite impact on location decisions. Situations in which this is true have been demonstrated historically and theoretically. Whether or not this impact is significant in any given instance, however, will depend on the complex of location factors with which it is associated and with which it must be considered.

Microfilm \$2.75; Xerox \$8.20. 178 pages.

ECONOMICS, COMMERCE — BUSINESS

THE DEVELOPMENT OF UNION-MANAGEMENT COOPERATION IN SUPERVISORY TRAINING BY THE CONFERENCE METHOD

(L. C. Card No. Mic 61-532)

Arthur J. D. Cook, Ph.D.
University of Kansas, 1957

The narrowing of the areas of union-management conflict is considered by many experts as an essential next

step in the development of collective bargaining and the preservation of American democracy and productivity. Certain of the basic requirements for this process, usually called union-management cooperation, are known but little has been done in trying to develop union-management cooperation once the basic requirements are present. The present study is a description of such an attempt in the field of supervisory training in electrical contracting.

The subject of the study is the improving of relations between a local union, a member of one of the large internationals, and a contractors association which find themselves faced by low cost competition which threatens the well-being of both organizations. This threat, which can only be met by joint union-association action, requires a change from antagonistic cooperation to true cooperation, particularly in the area of productivity to offset the lower costs of the competition.

The writer was introduced to the problem by the Business Manager of the Union who was seeking an answer to this threat to the security of the Union members. An investigation of the productivity problem disclosed that the most important cause for low productivity was the antagonistic attitude displayed by Union members and Association members toward each other which prevented the type of communication between Union foremen and contractors that was necessary before an increase in productivity could take place. This required recognition by both sides of the mutuality of their interests in this area and of the need for joint action.

The writer attempted to solve this problem by establishing conference groups with the Union members to discuss their job problems and seeking to interest contractors in the course so that they would attend the meetings. The study is a case description of the process.

The first two chapters define union-management cooperation, conditions under which it has been most effective and give a brief history of the most successful attempts at such cooperation. Chapters three and four describe the Union and the Association, their histories and give the background of the problem. The fifth chapter gives the conceptual scheme of the study and the methodology used. The next three chapters give the development of the courses and the subject matter for each meeting. The ninth chapter illustrates the courses by selected transcriptions while the last two chapters are a statistical analysis and the conclusions drawn from the study. In addition, there are five appendices.

Despite the lack of control groups, the results of the study show that the conference method of teaching can be a useful tool in improving relations between two antagonistic groups which are faced by a common challenge to their economic life. It provides a means for face-to-face communication which lessens hostility and makes recognition of common needs and objectives easier for the participants. Before it can be successful, however, it apparently requires a common challenge, a conference leader who is trusted by both sides and who has, at least, a minimum of skills as a group leader, and a recognized objective that promises benefits to both sides.

Under these conditions, the conference courses used brought about recognition of the problems of communication by both the Union and the Association and laid the ground work for joint plans to increase supervisory and journeyman training.

Microfilm \$3.10; Xerox \$10.80. 238 pages.

GOVERNMENT TRANSPORTATION — THE REDUCED RATE CONTROVERSY.

(L. C. Card No. Mic 61-505)

Herschel Cutler, Ph.D.
Syracuse University, 1960

The federal government purchases more transportation services than any other shipper in the world. State and local governments also purchase vast amounts of transport services. Thus, government is the major single customer of the American transportation industry.

A study of the rates and conditions which apply in the movement of government traffic should disclose significant information about pricing and other practices if for no other reason than the fact that the amount of traffic involved is so large. However, the various governments are eligible for reductions in rates and for other transport concessions, and a sharp differentiation of markets occurs. Transport rate and service concessions are granted to governments but they are not available to the great majority of American shippers. The exclusive nature of these agreements means that the government and the commercial markets are serviced by the carriers as if they were unrelated. The carriers' actions in one market in no way justify or dictate their actions in the other.

Because transportation is a decreasing cost industry, and because transport firms from time to time are faced with the problem of excess capacity and empty return hauls, the freedom from regulation permitted by concession clauses may lead to rate practices in the movement of government traffic substantially different from those obtaining with commercial traffic. A carrier may be forced by competition to quote rates to the government far below commercial rates on comparable commodities in the hope that the large amounts of government tonnage will result in revenues which will compensate for the reductions in rates. The results of this competition are that rate quotations have been forced to levels below out-of-pocket cost as carriers vie for government tonnage.

Competition often causes carriers to tender their services at rates which approximate marginal cost. Continued pressures, however, force carriers to price under what is here called the "theory of competitive contribution." The major element recognized by this theory is that although a positive contribution to overhead is the intent of every quotation submitted to government, if competition will not allow a positive contribution, a negative contribution will often be accepted by the carriers.

After developing the history of transportation concessions to the various governments, this dissertation discusses the current controversy resulting from the effects of the "theory of competitive contribution." The dissertation concludes that concessions are required only as a military weapon and that they must be used sparingly if the transport system is best to serve the needs of commerce and defense.

Microfilm \$3.80; Xerox \$13.30. 293 pages.

THE QUANTIFICATION OF MANAGERIAL DECISION PROBLEMS

(L. C. Card No. Mic 61-233)

Herbert Gosa Hicks, Ph.D.
University of Alabama, 1960

Beginning with a treatment of the historical background and the rationality of quantification as an aid to management, procedures are developed for quantifying the various functions of an enterprise. Specific problem areas include profit analysis, economic lot sizes, capital goods selection and replacement, and marketing. Appropriate examples of the use of quantification in each of these subject areas are included. By extending the use of quantification to its fruition and logical conclusion, a procedure is offered through which two or more functions of an enterprise may be quantified. The managerial viewpoint is taken throughout the entire work. Thus, the following basic objectives are accomplished: (1) to demonstrate the value of relatively simple mathematical techniques as aids in the solution of managerial decision problems and to illustrate their application, (2) to provide an integrated presentation of the use of such techniques, and (3) to offer a procedure which leads toward the quantification of an entire enterprise.

Microfilm \$2.75; Xerox \$8.20. 179 pages.

INSTRUCTIONAL ACCOUNTING PROGRAMS IN CHURCH-RELATED COLLEGES

(L. C. Card No. Mic 60-6320)

Zack Orville Albert Riggs, Ph.D.
Indiana University, 1960

Problem

The problem was a study of instructional accounting programs in church-related colleges. Specifically, there were two major aspects. The first pertains to identifying and classifying the characteristics and current practices of instructional accounting programs related to: (1) curricular offerings, (2) facilities and equipment, (3) administrative policies and practices, and (4) faculty status and qualifications. The second aspect was a comparison of the characteristics and current practices of the instructional accounting programs with the prevailing thought as revealed in the literature.

Procedure

To determine which colleges should be included in this study, criteria for selection were developed in order that only typical church-related colleges would be investigated. To compile the list of colleges, the seventh edition of American Universities and Colleges was examined to determine which colleges met the established criteria. Copies of a questionnaire constructed for the purpose of collecting data on the characteristics and current practices of instructional accounting programs were mailed to individuals designated by the college deans as being primarily responsible for these programs. Completed

questionnaires were received from respondents at 194 colleges, or 84 per cent. A survey of the literature was made to obtain the prevailing thought pertaining to the characteristics and current practices. A comparison between the characteristics and current practices of the instructional accounting programs and the prevailing thought was used as a basis for the solution to the problem.

Findings

The curricular offerings in accounting at most colleges appeared to be sufficient, although not proliferous, and were offered at the proper class level (freshman, sophomore, junior, and senior) when compared with the prevailing thought. The semester hours of accounting offered at the various institutions ranged from a low of 3 to a high of 64, with a median of 21. There was a tendency for colleges to add courses rather than to delete them.

Most colleges appeared to have adequate facilities and equipment necessary for conducting their instructional accounting programs. Electrical computing machines were more widely used than were the manual type. The blackboard and bulletin boards were the visual aids most often used. Classroom conditions as they were related to light, temperature, and ventilation did not appear to be a major problem, although less than one-fourth of the respondents expressed complete satisfaction on all three counts.

Accounting enrollments over a three-year period had increased at most colleges; however, seldom was effort made to recruit students with high potential in accounting, although this was recommended by the prevailing thought. The majority of accounting teachers were well qualified academically; however, approximately one-third were employed on a part-time basis.

Accounting teachers participated in writing activities worthy of publication in the area of accounting to a very limited extent. Full-time accounting teachers were less inclined to belong to professional accounting organizations than were those employed on a part-time basis.

Observations

The characteristics and current practices of the instructional accounting programs of the church-related colleges included in this study, when compared with the prevailing thought in the literature, were found to reflect credit upon these institutions. Although it would be untrue to imply that no weaknesses existed, it must be concluded that these programs, as a group, were educationally sound and were fulfilling satisfactorily their primary objectives.

Microfilm \$3.80; Xerox \$13.30. 294 pages.

ECONOMICS, FINANCE

PROBLEMS IN THE FINANCIAL MANAGEMENT OF FOREIGN OPERATIONS

(L. C. Card No. Mic 60-6758)

Alan Brouse Coleman, Ph.D.
Stanford University, 1960

Manufacturing abroad creates new administrative problems in financial management due to factors peculiar to foreign operations. These include: geographic remoteness; differences among nations in culture, law, economy, and commercial customs; and language, distance, and time barriers which complicate communications. These factors often oblige American executives to seek greater adaptability in international business administration through delegation of financial authority to foreign subsidiaries. Broad decision-making authority abroad is vital to successful management of foreign operations.

This study analyzes the division of financial management between parent companies and their overseas manufacturing subsidiaries. Attention centers on which finance functions may be delegated effectively to foreign subsidiaries, and which should be retained by parent management. The study also examines reporting and communication to learn how delegation of financial authority abroad affects parent company supervision and control.

Two methods of collecting data were employed: library research produced some information about the policies and procedures of fifteen international companies; field research was undertaken in twelve American firms, and six of their Western European subsidiaries.

Nine companies studied had granted to foreign executives broad authority over working capital, including management of: cash, accounts receivable, inventory, banking relations, and loan agreements. Political and economic conditions overseas often made such delegation a virtual necessity. Parent company control over working capital was preserved primarily through policy formulation and budgetary procedures.

Long-term financial management, such as dividend policy and capital budgeting, was more highly centralized. Parent executives frequently were obliged, however, to solicit much overseas advice before making decisions, particularly on dividend policy. Foreign political and economic uncertainties often made close collaboration essential.

Capital expenditures were subject to home office confirmation when individual projects exceeded certain amounts, often \$2,500 - \$5,000. Parent management attitudes and opinions heavily influenced foreign capital investment. Domestic expenditure proposals usually received priority over foreign opportunities and many companies limited overseas expansion to funds available locally.

Executives agreed that efficient financial communication was greatly complicated in foreign operations due to language, distance, and time barriers. The parent company's need for environmental information, particularly on political and economic developments, was crucial. Exchange visits among American and foreign personnel were essential in appraising overseas performance and prospects.

The relationship between the delegation of authority and the volume of information transmitted to the parent company

was a critical problem. Excessive detail and multiplication of reports were common difficulties. A satisfactory compromise was best accomplished by distinguishing between home office reporting needs for general supervision contrasted with parent decision making on individual operating matters. In these broad categories, different kinds of data and detail were needed.

Foreign operations require a management philosophy and policy formulation which are especially designed for an overseas enterprise. International business administration should not be determined by the literal extension overseas of domestic operating methods.

Executives agreed there was greater need for decentralized financial decision making in foreign compared with domestic operations. Several aspects of finance could be managed most efficiently through delegation of authority over them to foreign subsidiaries; this was especially true of working capital administration.

Although long-term financial management must remain more centralized, there is, nonetheless, a need for greater authority abroad compared to a decentralized domestic organization. Uniform policies are less effective overseas and more individualized decision making is required. The solicitation of foreign management advice on long-term financial questions is a vital pre-condition to parent company decisions when authority is centralized.

An international organization's ability to implement financial decentralization effectively depends upon the calibre of personnel, especially foreign management. Decentralization demands highly qualified executives capable of thinking creatively, planning intelligently, making sound business decisions, and then carrying them out with energy and imagination.

Microfilm \$3.40; Xerox \$11.95. 264 pages.

THE ECONOMICS OF URBAN RENEWAL: AN EVALUATION OF THE FEDERAL PROGRAM.

(L. C. Card No. Mic 61-412)

Robert Charles Davenport, Ph.D.
University of Maryland, 1960

Supervisor: Professor Henry Grayson

On December 31, 1958, the Federal urban renewal program included 648 projects in 386 communities, with total Federal grants-in-aid to be provided of \$1.35 billion. The problem under attack is the decay and obsolescence of our 168 standard metropolitan areas in which 84.5 million people live and work.

The urban renewal process begins with the selection of an area, predominantly residential in use or intended reuse, built-up, and blighted. A redevelopment plan is prepared and submitted to the Federal and local governments.

After the plan has been approved the land is acquired by purchase or condemnation, residents are relocated to other housing, and the structures are demolished. The cleared site is then sold to a purchaser who pays a reduced price based on the value for the intended use: residential, commercial, industrial, or public.

Of the 1,262 cities with a population of 10,000 or over, 295, or 23.4 per cent were participating in the urban re-

newal program on December 31, 1958. The 347 projects approved for advanced planning or execution on that date included 151,309 substandard dwelling units in their project areas. Proposed new dwelling units totalled 114,955. Quantitatively, the contribution of the urban renewal program to a solution of the problem of 4 million substandard dwelling units in our standard metropolitan areas is not significant.

For 246 urban renewal projects, the amounts to be spent for construction are (in millions of dollars); private, residential, 849; commercial, 475; and industrial, 206.9; public and semi-public, residential, 46.4; nonresidential, 736.9; site improvements, 88.8; major transportation, 43; total, \$2.4 billion.

The economic effects of these expenditures may be classified as product effects and process effects. The product effects include the rehousing in standard housing of many persons living in slums, better locations for industrial concerns with respect to transportation, access to markets, and space requirements; upgrading of such community facilities as schools and civic centers; better traffic flow from street widenings and reconstruction, with more light and air for adjacent structures. Tax revenues will increase from redeveloped areas, and there is, in addition, a reduction in the time and cost of the journey to work resulting from in-town residential projects.

Process effects arising from these construction expenditures of \$2.4 billion are estimated to result eventually in the creation of 137,710 man years of labor. The benefit-cost calculus may be used in project evaluation. Benefits are valued at market prices, costs are project capital costs. The benefit-cost ratios of the Riverside-Amsterdam project in New York are 0.66, 1.0 and 1.45, if the discount rates used in finding the present value of benefits are 0.0744, 0.04, and 0.0125, respectively.

An expanded urban renewal program is suggested for distressed areas. Repairing and rehabilitating the approximately 173,000 substandard dwelling units in eight such areas with 94,900 unemployed would require an investment of about \$2.04 billion and would provide employment for some 17,000 workers over a decade.

In a static fiscal policy framework, a tax financed expansion of public expenditures for urban renewal would raise the government expenditures component of GNP and thus close a deflationary gap. In a similar static treatment, an inflationary gap can be closed by raising taxes to siphon off excess demand in the private sector, without reducing public expenditures for urban renewal.

From the standpoint of dynamic fiscal policy, the productivity ratio of urban renewal investment is lower than other forms of investment. Consequently the income growth required for full utilization of a growing capital stock varies inversely with the fraction of total investment devoted to urban renewal investment.

Recommendations include: a tax financed expansion of the urban renewal program to \$1 billion a year in Federal grants-in-aid to cities; Federal definitive loans to cities to finance the leasehold disposition of land and nonresidential structures to private redevelopers; government sponsored research on urban form and function; and an inquiry into the economic feasibility of a new towns program to supplement the urban renewal program.

Microfilm \$2.75; Xerox \$7.80. 167 pages.

A STUDY OF THE PEOPLE'S BANK OF CHINA

(L. C. Card No. Mic 60-6627)

James Chao-seng Ma, Ph.D.
The University of Texas, 1960

Supervisor: Charles L. Prather, Ph.D.

Purpose of Study

The purpose of this study is to examine the organization and operation of the People's Bank of China. The People's Bank of China is known as the central bank in Communist China. In addition to performing the functions which are usually associated with those of a central bank such as note issue and acting as fiscal agent for the government, the People's Bank of China also engages in numerous activities of a commercial bank. These functions include the acceptance of deposits from the general public, the issuance of loans, and the remittance of money. The People's Bank of China operates a network of branch banks and subsidiaries in provincial capitals, municipalities, and rural towns and villages. Other government and private banks in Communist China are subject to its supervision, inspection, and guidance.

Plan of Study

First, an attempt is made to describe the economic system and banking institutions in Communist China. This serves as a background for the study.

Second, a discussion is given of the organizational structure, note issue, cash and currency control, various types of savings deposits, rural banking and loan policy, remittance and foreign exchange of the People's Bank of China.

Third, the relationship between the People's Bank of China and the state budget is discussed.

Summary and Conclusions

The People's Bank of China, under the cash control measures adopted on March 3, 1950, and the currency control measures introduced on December 25 of the same year, was designated as the banking institution to receive government deposits, the center of bill clearing, and the only institutional source of short-term credit. All state enterprises and public agencies are required to keep their deposits in the People's Bank of China. Along with these deposits, the People's Bank of China provided for various types of savings deposits and accepted a large number of savings accounts from urban and rural centers. All receipts and payments between the state enterprises and public agencies must go through the People's Bank of China. The People's Bank of China is responsible for the supervision of credit extended for purposes designated by the government. Through its branches and sub-offices and assisted by the credit co-operatives, the People's Bank also grants credit to farmers. Resources for credit operations consist of all public and private funds deposited in the Bank. The People's Bank of China, of course, may increase its resources by printing additional bank notes (jen min-pi). It also receives budgetary surpluses allocated by the government for credit expansion.

It is concluded that the People's Bank of China, through cash and currency control measures and allocation of

savings, plays a vital role in credit control. It helps to stabilize commodity prices by restricting the use of cash and reducing the velocity and quantity of currency in circulation. Furthermore, as the only institutional source of short-term credit, the People's Bank of China has apparently promoted the economic development in Communist China. However, it is not certain that the People's Bank of China has been able, as a financial supervisory organ, to direct the production of state enterprises without serious disruption.

Microfilm \$2.75; Xerox \$8.40. 182 pages.

THE ORIGINS OF THE INTERNATIONAL MONETARY FUND

(L. C. Card No. Mic 60-6991)

Lawrence F. Mansfield, Ph.D.
The University of North Carolina, 1960

Supervisor: Clarence Philbrook

The International Monetary Fund is one of the results of an attempt to reorganize international economic relationships after World War II. It was supposed to be one of three international economic agencies which, among them, would bring to the world economy an order which had been conspicuously lacking during the period between the world wars. The other two were the International Bank for Reconstruction and Development and the International Trade Organization.

One of the reasons for the Fund's lack of success since its foundation is the fact that the International Trade Organization never came into existence. There was, therefore, no international agency which could exert pressure on individual countries to discard war-created controls and create a multilateral world trading system in the same way that the Fund has exerted pressure for creating a multilateral payments system. The Fund's efforts in the monetary field have thus for a long time been nullified by the persistence of controls in a sphere largely outside its jurisdiction.

More important in explaining the Fund's record, however, is the fact that, in the process of political compromise which created it, it lost the internal logic and consistency of the original plans of Harry White and John Maynard Keynes. If the Fund had been placed in the context of the domestic monetary and fiscal policies which Keynes and White both contemplated, there would have been no mechanism by which the international economy could adjust to a disturbance in the pattern of world payments.

The present study traces the development of the Fund from the very beginning of postwar planning (in 1940) to the inaugural meeting of the Boards of Governors of the Fund and the Bank at Savannah in 1946. To place this development in proper perspective, there is included a discussion of the theoretical background of the problems with which the Fund was supposed to deal and a description of the historical background out of which White's and Keynes' plans developed. Finally, the Fund is evaluated as a device for accomplishing its purposes and the alternatives to it are briefly discussed.

Microfilm \$5.65; Xerox \$20.05. 441 pages.

THE SMALL-LOAN INDUSTRY IN TEXAS

(L. C. Card No. Mic 60-6653)

Donald Andrew Tyree, Ph.D.
The University of Texas, 1959

Supervisor: Dr. Charles L. Prather

This study has three main purposes: to present statistical characteristics of the market, product and institution of the small-loan industry in Texas; to describe and analyze regulatory laws of the state which currently apply to the industry; to present principles of small-loan regulation in an attempt to suggest essentials of an adequate small-loan statute for Texas. A minor purpose of the study is to trace the development of Texas legislation pertaining to the industry.

For many years Texas has been labeled the "leading loan shark state." Small-loan charges in Texas exceeding an effective annual interest rate of 200 per cent are not uncommon. The existence of numerous loan sharks in the state may be attributed to the lack of adequate legislation concerning the small-loan finance field. An antiquated usury law (contained in the state constitution since 1876) limits the lawful contract rate of interest to 10 per cent per annum. Nationwide experience seems to indicate that this rate is insufficient to induce capital investment in the small-loan industry. Thus, the state usury law has prevented legitimate lenders from fully competing with loan sharks who fulfill the necessary loan service at exorbitant loan charges.

Today, two types of lenders operate in Texas: the certificate lender; the unregulated lender. The latter type uses various lending devices to avoid usury regulations such as the "open note plan," the "brokerage plan," the "supplemental charge plan," and the "credit insurance plan." Until 1958 when the state reduced permissible credit insurance premiums and commissions, lenders could supplement their interest revenues by collecting excessive credit life, health and accident insurance premiums from borrowers. On the other hand, the certificate lender group is composed, in general, of ethical lenders operating according to provisions of the Industrial Loan Law (a law similar to an industrial or Morris Plan banking company act).

Statistical data for 1957 provided by the Texas Consumer Finance Association indicates that a certificate lender's loan office will make an average number of 1,274 loans totaling \$607,920 per year. While between 84 and 96 per cent of the certificate lenders' assets consist of loans receivable, approximately 50 per cent or more of their liabilities are long-term debt obligations. Bank loans appeared to be the chief source of credit for a small-loan company, regardless of its size. In 1957, thirteen certificate lenders earned a return on investment of 6.69 per cent including insurance profits, and 1.34 per cent excluding insurance profits.

In 1957, the average size of loan made by certificate lenders was \$465, was outstanding for more than 16 months, and was generally secured by a pledge of household chattels. During 1957, the "average Texas borrower" was between twenty-one and thirty-five years old, a skilled or semi-skilled worker earning about \$327 per month who obtained a loan to refinance or consolidate some of his outstanding debts. Generally, statistics of

loan and borrower characteristics of the legitimate industry in Texas are similar to those of other states (with small-loan laws), except that a much larger average loan is made in Texas.

In order to accomplish equitable small-loan regulation, it is necessary to observe and adhere to loan rate-making principles of (1) adequacy of rates, (2) reasonableness of rates, (3) equity of rates, (4) rates as a stimulus for a complete loan service, and (5) recognition of practical considerations in rate-making. Rate determination, licensing standards, supervision, reports and examinations, and penalties must all be considered prior to the adoption of a small-loan law. The sale of credit insurance in the small-loan field involves a controversial issue of significant purport not completely settled.

From the study certain conclusions are drawn.

(1) Loan shark activities are prevalent in Texas; however, a large group of lenders is operating legitimately as certificate lenders. (2) The usury law should be amended to allow the legislature authority to set an adequate loan rate for small-loan transactions. (3) The Industrial Loan Law has allowed many lenders to operate legitimately, but the law has many defects and may ultimately be used by abusive lenders. (4) Credit insurance is adequately regulated in Texas, but group credit life insurance is not. (5) Texas should adopt a small-loan law based upon the Uniform Small Loan Law and the Model Consumer Finance Act with the incorporation of specifically recommended modifications. (6) Further study of the small-loan industry and the sale of credit insurance in Texas should be encouraged in the future.

Microfilm \$3.60; Xerox \$12.60. 279 pages.

ECONOMICS, HISTORY

THE EMERGENCE OF NEW COMPETITION IN THE AMERICAN PETROLEUM INDUSTRY BEFORE 1911

(L. C. Card No. Mic 60-6530)

Ralph Louis Andreano, Ph.D.
Northwestern University, 1960

The Standard Oil Company in the late 1870's through a grand plan of merger, consolidation, and control of the means of transportation gained a virtual monopoly position in the American petroleum industry. It has been quite commonly assumed among leading scholars that this position was not seriously challenged for thirty years, i.e., from roughly 1880 to 1911 when Standard was dissolved by a decree of the United States Supreme Court.

This study takes issue with this interpretation and is directed toward providing a more complete and balanced appraisal of Standard Oil's place in the industry between 1880 and 1911, with special reference to the reasons for its failure to maintain its position in the industry. The conclusion of the study is that Standard's 1880 position well before 1911, was changed materially because of the organization's ineffectiveness in prohibiting entry into the industry. Four factors accounted for this.

1. Miscalculations on the part of Standard management either as to the relative importance of certain new crude oil discoveries or the quickness with which the company's resources were mobilized to keep these fields under control.

2. The timing and location of the new crude oil discoveries made it necessary for Standard to spread its investment resources more thinly than was appropriate.

3. The commercial and refining quality of the new crude oil discoveries facilitated the development of new products and accelerated the ability of entrants to explore new segments of demand for petroleum.

4. The impracticality and unprofitability for Standard to continue the policy of merger and consolidation to keep control of crude supplies and refining capacity: as one group of new rivals was acquired still another emerged.

Thus by 1911 new products, new firms, and new sources of crude supplies effectively altered Standard Oil's position. Growth in the number and size distribution of new firms paralleled the new crude oil discoveries and it was by this process that Standard Oil's monopoly control was broken and that the structure of the American petroleum industry was reorganized between 1880 and 1911. Microfilm \$5.50; Xerox \$19.35. 429 pages.

**A STUDY OF UNITED FRUIT
COMPANY OPERATIONS IN
ISTHMIAN AMERICA, 1946-1956**

(L. C. Card No. Mic 60-2965)

Richard Allen LaBarge, Ph.D.
Duke University, 1960

Chairman: Robert S. Smith

This dissertation is a study in the applied theory of economic change. It has been written for the purpose of providing information on the post-World War II operations of the United Fruit Company in Isthmian America. The study contains six chapters. The introductory chapter traces the history of banana culture to the close of World War II. The second chapter describes the production processes employed by the United Fruit Company in growing its major cash crops: abacá, African palm, bananas, and cacao. Chapter III discusses Company operations from the standpoint of aggregative economics. Value added by those operations to the major product aggregates for Guatemala, Honduras, Costa Rica, and Panama is presented together with a discussion of the secondary effects of Company spending. Chapters IV and V discuss the use and remuneration of the productive factors employed by United Fruit. Chapter IV is concerned with fixed capital and land, investigating the returns earned by these resources and the conditions influencing the Company's propensity to invest in them. Chapter V discusses the conditions affecting labor supply, productivity, the historical development of labor-management relations, and some of the socio-economic determinants of those relations. Chapter VI presents a brief summary of the major conclusions of the study.

The dissertation also contains two appendixes and a bibliography. Appendix A presents sectorized social accounts for the transactions of United Fruit Company subsidiaries in each of the four countries involved, while Appendix B discusses the estimation procedures used in deriving certain of the data employed in the accounts. The bibliography contains approximately eight hundred references which are relevant either to United Fruit Company operations or to the general economic development of the Isthmian region.

The dissertation also embodies the results of original field research conducted during seven months in Guatemala, Honduras, Costa Rica, and Panama. Approximately half of this time was devoted to studies in the archives, libraries, and government offices of the respective capital cities. In addition, each of the eight Isthmian divisions were visited to observe the conditions under which each division combined the productive factors at its disposal and to ascertain the quality of the goods and services produced by each division. Most of the data employed came directly from the internal records of the United Fruit Company.

Financial support for the dissertation was provided by a Research Training Fellowship from the Social Science Research Council.

Microfilm \$6.15; Xerox \$21.85. 484 pages.

**THE HOUSE OF JOHN NORTON AND SONS:
A STUDY OF THE CONSIGNMENT
METHOD OF MARKETING TOBACCO
FROM VIRGINIA TO ENGLAND.**

(L. C. Card No. Mic 60-4254)

Samuel Michael Rosenblatt, Ph.D.
Rutgers University, 1960

Supervisor: Professor Max Gideonse

This study, based upon the papers of John Norton & Sons, tobacco merchants of London and Virginia, examines the business relationships in the tobacco trade in the era of the American Revolution. The papers of the firm consisted primarily of the correspondence between the London consignment merchant, John Norton, his Virginia representative and eldest son, John Hatley Norton, and the Virginia planters who consigned tobacco to the firm. These letters, plus those of other planters and merchants, revealed the personal aspects of this trade as well as its mechanism. John Norton, acting as a commission agent for his Virginia correspondents, performed a variety of services. He assumed full responsibility for the sale of the planter's tobacco in England, provided transportation and insurance for the Atlantic voyage, and paid the British customs duties. He also purchased and shipped to the planters English supplies and manufactures. Most crucial of all he acted as a banker for the planters. In this capacity he not only financed the transportation and sale of their tobacco, but he also honored the bills of exchange they drew on him for other purposes, such as the payment of debts to others, or the purchase of West Indian goods. In these ways John Norton advanced his credit to the Virginia planters.

This credit, and the use that was made of it, is the key to understanding the consignment system. It is the contention of this paper that the relationship between the merchant and planter was much more than a simple principal-agent one, and that both parties were aware of a mutual obligation to each other, as well as a need for mutual trust for each other. This is quite clearly illustrated in the correspondence between John Norton and Robert Carter Nicholas, the Treasurer of Virginia. Even if this correspondence is considered an extreme case, because of the close friendship that existed between the two men, the rest of the evidence examined reveals a recognition by other planters and merchants of this duality of responsibility and interest. Further it is contended that the benefits of the consignment system were not altogether one-sided in favor of the merchant. It is true that the London merchants appeared to be making a substantial profit in this trade. Nevertheless a good part of the profit depended upon the uninterrupted continuance of the trade, as the interlude caused by the Revolutionary war showed.

Further some of this profit might never be realized, since it was represented by claims against the planters, which might never be collected. But even for the planters, mired in debt to the merchant as he apparently was, there existed certain compensations. Once a satisfactory relationship had been established with an English consignment merchant, the planter had at his command the resources of the most superior credit system then in existence. In an age when personal acquaintance and friendship was the substitute for impersonal banking, and also when the colony of Virginia was always hardpressed for circulating media of exchange, the importance to the planter of this contract with London or another city can hardly be overstated. The planter used this source of credit to maintain and expand his own personal domain. Thus in a very real sense, the credit of the English mercantile class went a long way toward financing the growth and development of the Virginia economy.

Microfilm \$3.65; Xerox \$12.85. 282 pages.

EDUCATION

EDUCATION, GENERAL

AN APPRAISAL OF THE ADMINISTRATIVE AND ORGANIZATIONAL ARRANGEMENTS FOR PROGRAMS OF SPANISH IN FLORIDA HIGH SCHOOLS

(L. C. Card No. Mic 60-6658)

Olie Sherman Bandy, Ed.D.
The University of Florida, 1960

The Problem

The purpose of this study of various factors involved in the operation of successful programs of Spanish in the public secondary schools of Florida was to provide:

1. Guidelines for the organization and administration of successful foreign language programs in all of Florida's secondary schools.
2. Better instruction in all modern foreign languages.
3. Extension of the period of foreign language study from the usual two-year course to three or four years.

Procedures

The first phase involved a survey of the development of foreign language teaching in the United States and in Florida. Criteria for a good program of Spanish in Florida high schools were then set up and validated. A compilation of the enrollments in all of the high schools of Florida having grades 9, 10, 11, and 12 was made and analyzed to discover which schools should be included in the sample. A questionnaire based on the criteria was devised and mailed to 134 high schools which appeared to be developing good programs of Spanish. The writer made

personal visits to 28 of these schools to confirm data and to secure additional information. Tabulations and analyses of the data were interpreted in terms of findings and implications. The county unit system of public schools in Florida provides a certain equality of opportunity and similarity of purposes and achievements in all the high schools in a given county.

Findings

Spanish was studied by 81.7% of all students of modern foreign language, and by 53.7% of all students of all foreign languages (including Latin).

Favorable conditions for teaching Spanish in Florida included well-qualified teachers; language laboratories, recording and playback equipment, books, periodicals, strong general interest in and tradition for Spanish; superior socio-economic conditions in many communities; good working relations among administrative, supervisory, guidance, and instructional personnel.

Unfavorable conditions included lack of the above conditions, too many small schools where teachers were required to teach other subjects in addition to Spanish.

During the 1959-1960 year, the third and fourth years in Spanish were in operation in 42 Florida high schools with 600 or more students -- 50% of the schools in this category. The third year of Spanish was offered in three smaller schools. Many schools have been authorized to extend instruction in Spanish to a full four-year program as soon as possible. This extension of instruction in Spanish has been amply justified in the increased accomplishment in language learning, in the joy accompanying the efforts of the teachers of the advanced classes, and in the resulting higher quality of education.

Some Implications of the Study

1. While the foreign language programs were found to be functioning well in most of the large and medium-size schools in Florida, it appears that considerable articulation and coordination are needed to improve modern foreign language programs in Florida. This becomes increasingly necessary as elementary and junior high school programs are getting started quite generally over the state.

2. More attention should be given to the provision of modern teaching equipment, materials, books, etc., and to in-service training of teachers in this field, especially in the smaller counties.

3. The utilization of human resources -- Spanish-speaking students and residents -- is of tremendous value in teaching Spanish in the Florida public schools.

4. A four-year program of Spanish studies in all Florida high schools with personnel and facilities to justify it should greatly improve the effectiveness and the lasting quality of instruction in this field.

Microfilm \$2.75; Xerox \$6.20. 130 pages.

AN ANALYSIS OF PLACEMENT SERVICES IN TWENTY-TWO INSTITUTIONS OF HIGHER LEARNING

(L. C. Card No. Mic 60-6600)

James Havens Bash, Ed.D.
University of Virginia, 1960

The general purpose of this study was to obtain information which would be useful to responsible officials in the organization and administration of placement services. Specifically, the study was developed to analyze placement services of selected institutions, to determine whether there are any especially effective placement techniques, and to determine whether there is a preferable plan of organizing placement in terms of the job-success of placed alumni.

Two institutions from each of eleven southern states participated. Fourteen small (0-2500 enrollment), four medium (2501-5000), and four large (over 5000 enrollment) institutions were selected as representative on the basis of size, source of financial support, classification of student body (co-educational, male, or female), and membership in the Southern College Placement Officers Association.

The data for this study were obtained from four separate sources. Twenty-five placement officers in the selected institutions, a five per cent sample of the June, 1958, graduates of the institutions, the job supervisors of the participating alumni, and the personnel directors of the employing agencies participated in the study. The alumni, job supervisors, and personnel director were supplied with questionnaires relating to the job success of the placed alumni and the preference of specific services of placement. The placement officers' questionnaire dealt with eight areas of placement operation. Additional information was obtained through personal interviews with the placement directors.

The plans of organization and the extent and scope of services provided by each of the placement offices were

determined. The level of alumni success on the job and their preference for specific placement services were ascertained. Job supervisors also evaluated the success of the alumni (employees), and the personnel directors ranked in the order of their preference specific services of placement.

The information thus obtained was analyzed. It was determined that, in general, placement offices provided those services highly preferred by both alumni and personnel directors. Vocational counseling was the only highly preferred service that was not provided by most of the offices. Based on a "success-index" developed for this study, it was found that the "small" institutions, as a group, more effectively placed their graduates in terms of the success on the job of their alumni. A further comparison of the success-indices revealed that there was no appreciable difference between the effectiveness of placement offices using either the centralized or decentralized plans of operation.

Although the data analyzed were obtained from twenty-two southern institutions, the conclusions that follow are believed to be applicable generally to programs of placement in institutions of higher learning.

1. With the exception of vocational counseling, the services of placement preferred by both alumni and personnel directors are being provided by placement offices. The expressed preferences of alumni and personnel officers indicated that the following should be considered basic services of placement offices:

- a. Arranging the employment interviews,
- b. Distributing occupational information and literature of employing agencies,
- c. Preparing confidential credentials,
- d. Arranging conferences between recruiters and faculty members, and
- e. Vocational counseling.

2. No unique nor especially effective techniques of placement were identified in this study. The findings suggest, however, that the practice of the placement officers recommending individuals for specific positions is a positive factor in effective placement.

3. No conclusive evidence was found to substantiate the thesis that effectiveness of placement is related to the plan of organization. The plans of organization reported were unique to the individual institutions and were related to factors other than size.

4. The success-index developed for use in this study provided a practical approach to the problem of determining the effectiveness of placement services in groups of institutions. With further refinement this technique may provide a means by which institutions may appraise the effectiveness of their placement offices.

Microfilm \$2.75; Xerox \$7.40. 156 pages.

THE RELATIONSHIP OF SELECTED
VARIABLES TO SUCCESS OF PART-TIME
RECREATION PERSONNEL EMPLOYED AS
SUMMER PLAYGROUND LEADERS

(L. C. Card No. Mic 60-6640)

Myrtle Lee Bell, Ed.D.
The University of Texas, 1960

Supervisor: Doctor David Kingsley Brace

The broad purpose of this study has been to contribute knowledge to the problem of prevocational selection of potentially successful part-time recreation personnel employed as summer playground leaders. Specifically, the purpose has been to examine the relationships of certain related qualities to ratings of success of employed summer playground leaders, and to determine from these relationships which combinations of measurement data might possibly aid in the evaluation and selection of summer playground leaders.

The subjects for the investigation included eighty male and eighty-four female playground leaders employed in four Texas cities during the summer of 1959. Sixteen supervisors contributed data used in the study as Criterion scores.

The rating scale used to obtain a Criterion score for each leader was devised by the jury technique and subjected to chi square analyses to determine the validity of the rating scale items. The reliability and objectivity of the rating scale were determined by appropriate methods.

The instruments employed for gathering data about the leaders were the Otis Quick-Scoring Mental Ability Test (Gamma Test, Form E_M), the Guilford-Zimmerman Temperament Survey, the Brace Motor Ability Test, the Kuder Preference Record (Vocational, Form CM), and a Personal Data Sheet. The relationship of success to height, weight, age, marital status, experience, intelligence, behavior tendencies, vocational interests, and motor ability was determined by computing the coefficients of multiple correlation from the scores obtained from the male and female groups. The selection of four variables for each group was based on the low intercorrelations of the variables and their degree of validity. Beta coefficients and b weights were recomputed for the selected variables, and coefficients of multiple correlation were calculated. A multiple regression equation was then computed for each group.

From the data obtained from the male leaders, only two variables, Experience and the Kuder Mechanical Scale, were statistically significantly related to the criterion of success. Similarly for the female leaders, only two variables, Marital Status and the Kuder Social Service Scale, appeared significantly related to the Criterion.

Because of low intercorrelations and the degree of validity, four variables were selected for the male group and four variables were selected for the female group to use in developing multiple regression equations. The multiple regression equation for the male leader was:

$$\text{Criterion Score} = 1.73 \text{ Height} + 0.64 \text{ Experience} + .31 \text{ Mechanical} - .13 \text{ Personal Relations} + 23.87.$$

The multiple regression equation for the female leader was:

$$\text{Criterion Score} = 7.74 \text{ Marital Status} + .37 \text{ Experience} - .33 \text{ Social Service} - .52 \text{ Masculinity} + 183.23.$$

The reduction in size of error for predictions of criterion scores by using the regression equations, however, was almost negligible. It was concluded, therefore, that prediction by means of the equations would have little value unless there is a large number of applicants from which a very small number must be selected.

If the rating scale is a valid instrument for measuring success of playground leaders, the results of this study seem to indicate that the selected variables other than Experience and the Kuder Mechanical Scale for the male leaders and Marital Status and the Kuder Social Service Scale for the female leaders were insignificantly related to success as measured.

Microfilm \$2.75; Xerox \$6.80. 143 pages.

AN EVALUATION OF THE EFFECTIVENESS
OF A COLLEGIATE GENERAL
MATHEMATICS COURSE

(L. C. Card No. Mic 60-6606)

Lillian Katie Bradley, Ph.D.
The University of Texas, 1960

Supervisor: James W. Reynolds

The purpose of this study was to evaluate the effectiveness of the "General Mathematics" course which was offered at Texas College and The Tyler District College during the 1957-58 school term and the fall semester of the 1958-59 school term. This study consisted of determining: how the course fitted into the programs of the two colleges; the students' mathematical background and vocational background and aim; the objectives and content of the "General Mathematics" course as well as the objectives and content of general mathematics courses reported in the literature and general mathematics textbooks; and the extent to which the objectives of the "General Mathematics" were being achieved by the students.

An examination of the Texas College Bulletin (1957-58 issue) and the general education programs of the two colleges revealed that the course is required for all programs of both colleges. Background information concerning the eighty-five students involved in this study, as recorded in the registrars' offices, showed that 79 per cent of them presented more than two units of high school mathematics, with algebra I being the most frequently presented course. Results of the Cooperative School and College Ability Tests (quantitative section, form 1D) showed that 51 students ranked at or above the fiftieth percentile, while 42 ranked below the fiftieth percentile.

Student responses to a questionnaire indicated that a majority were interested in becoming teachers and their work experiences had involved only a limited amount of mathematics. A review of the course outlines and syllabi and interviews with the teachers of the course revealed that the objectives and content of the "General Mathematics" course agree generally with those reported in the literature and general mathematics textbooks.

To determine the extent that the course objectives are being achieved by the students, forms 1A and 1B of the Sequential Tests of Educational Progress were administered. Form 1A was administered to the students before they took the course and form 1B after completing it. An analysis of the test scores indicated that 79 students grew mathematically, while 6 lost ground. The average percentage of growth was 46.4 (20 points). The forty-five students who scored within the lower third interval on form 1A of the test showed more mathematical growth than the students who scored in the middle and upper third intervals. The greatest amount of growth appeared to be on the group of items classified under "Proof-deductive and inferential reasoning," while the least amount of growth appeared to be on "Symbolism." The results of this study indicated that the "General Mathematics" course was more effective for the poorer student concerning "Proof-deductive and inferential reasoning."

On the basis of the findings it was recommended that:

1. More opportunities, outside of class, be provided for the students found deficient in high school mathematics to build up a better proficiency in mathematics.
2. Considerable attention be devoted to making the mathematical symbols, terms, and concepts more meaningful to the students.
3. The types of course tests be varied; they should not all be of the type that calls for "mechanical procedures."
4. Applications used in the course come from a variety of areas since the course is required of all students.
5. The course be adapted to better provide for individual differences.
6. Experiences for creating a wholesome attitude toward mathematics be provided.
7. Much of the review material from the areas of arithmetic and algebra be omitted. If this were done there would be time for the inclusion of such topics as logic, the algebra of sets, and the more important topics from analytic geometry.

Microfilm \$2.85; Xerox \$9.90. 218 pages.

THE DESIGN, PRODUCTION, AND EVALUATION OF A VOCATIONAL GUIDANCE FILM ON OCCUPATIONS FOR THE QUINCY SCHOOL SYSTEM.

(L. C. Card No. Mic 61-241)

Frederic Roy Carlson, Ed.D.
Boston University School of Education, 1959

PROBLEM: The purpose of the study was to design, produce and evaluate a motion picture on occupations in the City of Quincy for the guidance department of the Quincy school system.

PROCEDURE: This involved, (1) the analysis of occupations in local business and industry to determine the emphasis in the motion picture, (2) the development of a shooting script and narration, and the actual filming, editing and recording of the sound motion picture, (3) and the administration of the evaluation questionnaires, one to the students to ascertain if there were any increase in knowledge about the area, and another to the teachers to ascertain if the film had met the production objectives.

The scope was limited to the teachers and high school students of the community of Quincy, Massachusetts. It also involved the cooperation of the school guidance people in the design and evaluation, the Quincy Chamber of Commerce to finance the project, one group of graduate students from the Motion Picture Department of the Boston University School of Public Relations and Communications to assist in the production of the film, and one group of graduate students from Boston College to help evaluate the film.

Production of the film was begun in June, 1955 and completed within one year. Administration of the pre and post evaluation devices was completed the year following the premier of the film.

FINDINGS AND CONCLUSIONS: The following conclusions may be drawn from the study:

1. A film was developed that illustrated approximately ninety occupations in realistic situations.
2. The appropriate grade placement for the film was judged to be senior high level.
3. The subject field to which the film was most applicable was group guidance.
4. The film met the production objectives that were determined in advance by the producer, as judged by the evaluation questionnaire.
5. The film was judged to be of professional quality.
6. Eighty-eight per cent of the students who responded to the questionnaire indicated they had learned more about Quincy from the film.
7. A majority of students (73 per cent) felt a need for additional education to qualify for the jobs of their choice.
8. Significant growth in knowledge about occupations depicted in the film was noted in the comparison of pre-test and post-test data.

THE FILM: The film represents the creative work and thus the major portion of the work of this thesis. Preview of the film is essential to give the reader a better understanding of the study.

Microfilm \$2.75; Xerox \$6.20. 130 pages.

THE RELATIONSHIP OF SIZE AND ORGANIZATIONAL TYPE TO CERTAIN FACTORS IN ALABAMA'S WHITE PUBLIC JUNIOR HIGH SCHOOLS

(L. C. Card No. Mic 61-230)

Jack W. Crocker, Ed.D.
University of Alabama, 1960

One purpose of this study was to determine whether the differences in the levels of academic preparation of junior

high school teachers in the subjects they were teaching were related to size and organizational type of schools. The other main purpose of the investigation was to determine whether there was a relationship between the size and organizational type of the schools and the variety of subjects offered.

Organizational types of schools considered were two-year junior high schools, three-year junior high schools, and junior high schools which comprised the lower three grades of six-year secondary schools. The two-year junior high schools and the three-year junior high schools were divided into the following size of enrollment categories: from 1 through 100, from 101 through 300, from 301 through 500, from 501 through 750, and 751 and above. Size was not considered in the treatment of the junior high schools which were a part of six-year secondary schools.

Two questionnaires were developed which were distributed in the spring of 1958. One was designed to obtain information concerning the academic training of the teachers and was sent to every secondary school teacher in the State of Alabama. This questionnaire was so designed that it was also possible to derive the number and percentage of teachers teaching and the number and percentage of students enrolled in each subject. The other questionnaire was sent to the secondary school principals requesting information concerning size of enrollment and organizational type of the schools. Ninety-five per cent of the teachers and principals responded.

It was found that, in general, as size of enrollment of schools rose, the level of college preparation of teachers in their subject matter fields increased. The main exception to this was the three-year junior high schools with 751 or more students enrolled. The level of preparation of teachers in these schools fell below the level of preparation of teachers in the three-year junior high schools enrolling 501 to 750 students.

In the two-year junior high schools, a higher percentage of eighth grade students, than seventh grade students, were taught English, general mathematics, social studies, and speech by teachers with the higher levels of college preparation in their subject matter fields. There was no obvious relationship between grade level and level of preparation of teachers in the three-year junior high schools. Grade level was not considered in the treatment of the junior high schools which were a part of six-year secondary schools.

The junior high schools which comprised the lower three grades of six-year secondary schools had the highest percentage of students taking subjects from teachers with majors or minors in their subject matter areas, followed by the three-year junior high schools and the two-year junior high schools in that order.

The two-year junior high schools with less than 301 students enrolled offered a wider variety of subjects than did the schools with 301 or more students enrolled. In the three-year junior high schools the variety of subjects offered tended to increase as size of enrollment of schools increased.

The three-year junior high schools offered a wider variety of subjects more consistently than did either of the other two types of junior high schools. The two-year junior high school ranked second in this respect, followed by the junior high schools which were a part of six-year secondary schools. Microfilm \$3.70; Xerox \$13.05. 288 pages.

PUBLIC SCHOOL DISCIPLINE IN CULTURAL PERSPECTIVE

(L. C. Card No. Mic 60-6049)

Enoch Spencer Drumm, Ed.D.
Indiana University, 1960

Chairman: Maurice E. Stapley

The problem as defined involves the task of identifying the significant cultural elements which enter into the public school disciplinary situation and of relating each element to the whole in historical perspective.

This study involves:

- A. The historical context of major cultural factors that underlie prevailing popular ideologies relating to public school discipline.
- B. Demonstration through analysis that certain cultural elements have been more effective than others in determining the nature and characteristics of the disciplinary situation.
- C. Identification of basic cultural elements in our present social structure which serve as foundation for our current ideologies relating to discipline.
- D. The consideration of diverse views regarding discipline, in order to discover possible schizoid influences which may exist within the culture, and which may be reflected in the confusing and conflicting complexity of the contemporary public school disciplinary scene.

The problem has been attacked chiefly by means of the techniques of historical research, and these findings have been used to construct a synthesis or overview.

Discipline is of major concern for all those who have an interest in the instructional program of the public schools. Discipline is pertinent in teacher-pupil relationships, and is a large factor in successful teaching. Both biological and cultural factors are involved. The biological factors might be identified as the discipline of organic necessity, while the cultural factors comprise the discipline of social inheritance. This study is primarily concerned with an examination of the disciplinary elements derived from the cultural inheritance.

Four institutions on the American scene emerge as prime conditioners of the social order. They determine the national way of life. These cardinal institutions include: the family, the church, the state, and the public school.

The family is one of the earliest of social inventions, and one of the most durable. It has primary responsibility for the nurture of the young, and is perhaps the most potent conditioner of character and personality.

The values of the Medieval World based upon the church as the final arbiter of life here and hereafter were transplanted almost intact to the New World. In the Colonial period, and for many generations thereafter, the disciplinary code of the public school reflected the pietistic beliefs of a Calvinist oriented Protestantism. The aim of the early schools was to create literate individuals who would be able to read the scripture.

The state, in order to survive, arranged to transmit many of the values formerly instilled by the home and church. Universal modes of behavior became the concern of the state.

The individual citizen, endowed with natural and inalienable rights, became the fountainhead and source of all civic power and authority. In theory, at least, the individual citizen was held to be capable of self-government. The will of the majority became the highest law of the land.

Self-government thus becomes the ultimate test of the degree of self-discipline exercised by its individual members.

The public schools have been assigned a major share of the responsibility for educating the youth of the land in order that they may become self-governing citizens in a democratic society. The school is a relatively late arrival and has been to a large degree created, shaped, and sustained by the family, church, and state. The disciplinary sanctions which it invokes reflect, in large measure, the prevailing values and philosophies of the contemporary culture.

At the present time, discipline in the public schools follows a more enlightened pattern than at any time in the past. Much new knowledge relating to the causes and control of behavior has been gained. It becomes increasingly evident that man's future involvement, or even survival, may depend upon his ability to achieve enlightened self-discipline. Microfilm \$2.75; Xerox \$8.40. 185 pages.

A SURVEY OF SELECTED PROVISIONS FOR HIGH SCHOOL SCIENCE INSTRUCTION IN FLORIDA

(L. C. Card No. Mic 60-6666)

Shepard Mazor Faber, Ed.D.
The University of Florida, 1960

The purpose of this study was to survey the status of science education in a 25 per cent random sample of the high schools in Florida.

Three areas of concern were chosen for investigation: (1) science course offerings and enrollments, (2) facilities and equipment, and (3) academic qualifications of science teachers.

Collection of data was made by, (1) a survey team that visited the 81 schools in the sample and completed itemized instruments relative to offerings, enrollments, facilities, and equipment; (2) an examination of the college transcripts of the 201 science teachers in these schools; and (3) an analysis of responses to a science teacher questionnaire.

Specific provisions selected for consideration were chosen on the basis of expert consensus and analyzed with respect to race and the following school size categories: 1-199, 200-499, 500-999, 1000-up. Several indices of compliance were derived to measure the extent to which the schools conformed to the recommendations of experts in the field of science education.

The major findings of the study are summarized as follows:

1. The percentage of the Florida schools offering any one of, or a combination of, general science, biology, chemistry, and physics was slightly greater than the combined average of the other states.

2. The number of different science courses offered in the schools was related to school enrollment; the larger a school, the more extensive its science curriculum.

3. The average science class was composed of 27 students; the larger schools had the largest science classes.

4. Two-thirds of the students were taking one or more science courses. Biology was the most popular science subject; physics was the least popular.

5. Although some of the high schools were moderately well equipped, most were so deficient in needed items as to seriously impair an effective science program. From an inventory of 380 basic items commonly used in teaching general science, biology, chemistry, and physics, it was found that most schools teaching these subjects had fewer than half.

6. Of the 315 teachers instructing one or more sections of science (grades 9-12), 8.6 per cent were not fully certified according to Florida certification requirements in effect as of June, 1959.

7. According to recommendations outlined by the National Society for the Study of Education, the average science teacher was found to have deficiencies both in the subject taught and in related subjects.

8. One-half of the science teachers indicated that lack of equipment and supplies was the greatest source of difficulty in their classes.

9. Three-fourths of the science teachers acknowledged a desire to take courses in science content to add to their competency as teachers.

On the basis of these findings, it was suggested that school officials give consideration to the following recommendations:

1. Extension of present science curriculum, particularly in the schools enrolling fewer than 200.

2. Amplification of present provisions for facilities and equipment.

3. Provisions for free time and/or assistants so that science teachers can prepare for class and maintain equipment.

4. Consolidation of smaller schools.

5. Organization of science materials center to provide science equipment on loan.

6. Provisions for in-service teachers to add to their academic background.

Microfilm \$3.45; Xerox \$12.15. 268 pages.

**A STUDY OF THE SECONDARY SCHOOL
DROP-OUT PROBLEM AT
PORT WASHINGTON, WISCONSIN, HIGH SCHOOL.**

(L. C. Card No. Mic 60-6545)

William John Fenelon, Ed.D.
Northwestern University, 1960

PURPOSE.

It was the purpose of this study to investigate the secondary school drop-out problem at Port Washington, Wisconsin, High School with regard to: (1) the number of students from six, four year classes during the years 1950-1959, who left school prior to graduation, (2) the backgrounds and status of a representative sampling of the students, (3) major causes of student drop-outs at Port Washington High School as indicated by the representative sampling, and (4) identification of possible means of improving the holding power of the high school.

METHODS.

By the use of a stratified random sampling technique, 111 of the 223 drop-outs for the period, or approximately 50 per cent of the total group, were selected for purposes of study. This sampling was to be surveyed by use of a questionnaire instrument developed by the writer. When a pilot study, involving 24 drop-outs, designed to empirically test the questionnaire and also measure possible response failed, it became necessary for the writer to use a personal interview method to gather data. The questionnaire that had been prepared was used as a guide to structure the interviews.

FINDINGS.

The findings of the study showed that 22 per cent of the students enrolled in six, four year classes during the period considered in the study, dropped out of school without graduating, with grades nine and ten most vulnerable to loss by drop-out. Non-resident students comprised the greatest number of early school leavers with the number of male drop-outs exceeding the number of female school leavers. A majority of drop-outs had average to above average measured mental ability. Marriage and health influenced a limited number of students to leave school, though they married later. The majority of Port Washington drop-outs came from families with five or less children, in which parents were living together and family income was adequate. Most parents had terminated their own education at the elementary school level. Drop-outs had attended both public and parochial elementary schools; rural and city type though students with rural type parochial school backgrounds left school in greatest numbers. Limited guidance experiences had been available at elementary and secondary levels, though students believed them valuable. The data showed that drop-outs had definite likes and dislikes in the matter of classes, teaching methods, and co-curricular activities. Though drop-outs believed in the worth of education, a limited number had continued their education.

Reasons for school leaving given by drop-outs included, in this rank: (1) dislike of school, (2) lack of academic

success, (3) work preference, (4) economic problems, (5) marriage, (6) family troubles, and (7) physical health.

CONCLUSIONS.

One could conclude from the data that while the Port Washington High School holding power average was better than the national average it was not as good as the Wisconsin average.

Background informational data about drop-outs seemed to indicate that there were considerable variances, even within one school situation. There were no findings conclusive enough to show definite relationships between individual backgrounds and early school leaving. An analysis of the findings seemed to indicate the need for further study of both background and apparent influences and their relationship to school drop-outs at Port Washington.

One could further conclude from the study that there seemed to be no single reason for early school leaving but that students left school for a number of reasons within one school situation.

Microfilm \$3.30; Xerox \$11.50. 255 pages.

**AN EVALUATION, BY A PARTIALLY
ILLUSTRATED TEST, OF CERTAIN
COMPETENCIES IN PERSONAL AND
FAMILY FINANCIAL MANAGEMENT
POSSESSED BY SELECTED SENIOR HIGH
SCHOOL STUDENTS.**

(L. C. Card No. Mic 61-38)

Ethelyn Crider Furrer, Ed.D.
The Pennsylvania State University, 1960

Statement of the Problem

The twofold problem of this study was the construction of a test to measure certain competencies in personal and family financial management and the evaluation of the extent of these competencies in a sample of senior high school students.

Need for the Study

The need for this study arises from one of the key objectives of American education, economic efficiency. Based on the assumption that the public high schools have an obligation to educate citizens for economic efficiency and can raise the level of efficiency in personal and family financial management, it is important to demonstrate the extent of certain competencies possessed by senior high school students.

Procedure

A preliminary instrument of 50 items for each of six areas of money management was designed. The areas were budgeting, banking, insurance, installment buying and credit, savings and investments, and providing a home. Each item, representing a particular competency, was rated by a jury of educators. After the 300 preliminary

items were administered to approximately 225 students, the test was revised for two parallel forms of 72 items each. Form 1 was administered to 458 students of eleventh and twelfth grades in two senior high schools of Pennsylvania. Form 2 was administered to 443 students of eleventh and twelfth grades in the same two high schools.

Conclusions

1. The test of money management demonstrated general weakness in certain competencies of personal and family financial management possessed by eleventh and twelfth grade students in all curricula.
2. The test demonstrated differences between the extent of certain competencies in personal and family financial management possessed by students completing a given grade in a particular curriculum and students completing the same grade in another curriculum.
 - a. There was no significant difference between college preparatory and business students and between vocational and general students.
 - b. There were significant differences between the extent of competencies possessed by college preparatory and vocational or general students in favor of the college preparatory students. There were significant differences between the extent of competencies possessed by business and vocational or general students in favor of the business students.
3. The test demonstrated general weakness in certain competencies of personal and family financial management possessed by both eleventh and twelfth grade students with no significant gain in extent of competencies possessed by twelfth grade students.
4. The test demonstrated least weakness in the areas of budgeting and banking and greatest weakness in the areas of insurance and providing a home.

Recommendations

1. Increased emphasis of instruction in personal and family financial management is recommended for students in all curricula.
2. Increased emphasis of instruction in personal and family financial management is recommended for grade levels other than the twelfth and particularly for the twelfth grade to sustain, reinforce, and extend competencies of personal and family financial management.
3. Increased emphasis of instruction is recommended in all areas of personal and family financial management.
4. It is recommended that administrators and guidance personnel use the test as a guidance instrument in selecting and scheduling students for further study in money management in the twelfth grade.
5. It is recommended that teachers use one form of the test for pre-testing and the other form for post-testing as a measure of student achievement.

Microfilm \$3.95; Xerox \$10.35. 228 pages.

A STUDY OF CONFLICTING CONCEPTS IN SECONDARY EDUCATION AS VIEWED BY PRINCIPALS, SUPERINTENDENTS, TEACHERS, SCHOOL BOARD CHAIRMEN, AND PROFESSORS OF EDUCATION IN THE ELEVEN STATES OF THE SOUTHERN ASSOCIATION OF COLLEGES AND SECONDARY SCHOOLS.

(L. C. Card No. Mic 60-3308)

William H. Hale, Jr., Ed.D.
The Florida State University, 1960

Purpose

The purposes of this study were, (1) to identify conflicting concepts in secondary education using as a basic resource the recommendations in James Bryant Conant's *The American High School Today*, and (2) to determine the degree of acceptance or nonacceptance of these recommendations among high school principals, high school teachers, superintendents, school board chairmen, and professors of education.

Procedures

The study was limited to the eleven states of the Southern Association of Colleges and Secondary Schools. A questionnaire was used for gathering the beliefs of the five groups comprising the data population. The questionnaire was developed in the following manner; (1) twenty-six specific concepts were taken from the recommendations of the Conant Report, (2) for each of these, two alternate concepts were identified from the literature and/or current practice, (3) these were arranged into twenty-six sets of statements which included a Conant concept and the two alternates to it.

Each recipient of the questionnaire was asked to select the concept from each set which most nearly expressed his beliefs concerning secondary education. The alternate concepts were chosen so that when combined with the Conant concept they covered a reasonable range of possibility.

In the analysis and interpretation of the data, a concept was considered acceptable when it was selected by 75 per cent or more of each of the five groups, and nonacceptable when it was selected by 25 per cent or less of each group.

When the data population failed to accept any of the alternates in a given set of concepts as acceptable or when there were significant differences in the way in which the groups comprising the data population selected the alternates, it was concluded that the concepts involved constitute an unresolved issue. The chi square test of significance was used to determine whether or not the observed differences in the way in which the groups selected the alternates were significantly different.

Summary and Conclusions

Only one of the Conant concepts was acceptable to the data population; namely, in each community in America, there should be comprehensive high schools in which the varying needs of all types of students are met. Five of the Conant concepts were nonacceptable. Of the twenty which were neither acceptable nor nonacceptable, five

were the most acceptable of the concepts presented and fifteen were not the most acceptable.

For twenty-three of the twenty-six sets of conflicting concepts it was found that they are still issues to be resolved. The remaining three sets apparently are not issues since the data population indicated clear direction concerning these areas in secondary education.

Microfilm \$2.75; Xerox \$7.40. 160 pages.

THE ABILITY OF THIRD GRADE CHILDREN TO INTERPRET GRAPHS

(L. C. Card No. Mic 60-6053)

Leo Merle Harper, Ed.D.
Indiana University, 1960

Chairman: Ruth G. Strickland

This research project was conducted with 407 subject pupils in fifteen classes near the end of the third grade in selected schools in Indianapolis. The purpose of the study was to determine the degree of ability pupils were able to manifest before any direct teaching planned to develop skills in the interpretation of graphs, the degree of ability they were able to manifest after teaching periods of from ten to fifteen minutes per day for two weeks, and the relationship between the scores achieved before and after the teaching period.

Sixteen graphs were prepared by the researcher. Four (one of each selected type) were used in a first test booklet, and four more were used in a final test booklet. The remaining eight graphs were reproduced in 2" x 2" slide form and used along with duplicates of the first test during the study period.

Tests were of the multiple choice type with four possible answers for each question. To avoid reading problems, the written information on the graphs and the questions on the tests were read for the children during the administration of the tests by the class room teachers in charge of subject pupils.

Results of each test were tabulated on individual pupil data cards and then consolidated to show group performance on each of the ten selected skills, on each of the four types of graphs, as well as the total performance in skill and on each type of graph.

Analysis of scores showed that the unit pictograph was easiest for pupils to interpret before the study period. The line graph was the most difficult. The bar graph with figures given and the bar graph on a grid fell between the unit pictograph and the line graph in order of difficulty with no appreciable difference between the latter two types.

The average per cent correct (based on corrected scores) achieved by the group on the test covering four graphs, and administered before the study was 31.58.

After the teaching period, the bar graph on a grid was the easiest for the pupils to interpret, followed by the bar graph with figures given, the unit pictograph and finally the line graph.

The average per cent correct on the final test was 50.62 for the 407 subject pupils.

The selected skills studied in inverse order of difficulty as determined by the final test scores were:

- Recognition of the purpose of the graph
- Reading of quantitative data for a specified time
- Recognition of the time unit
- Recognition of the value of the quantitative unit
- Reading of time when quantitative data were specified
- Comparison of quantities
- Prognosis of probable data beyond the graph into the future

Reasoning

Interpolation of data

Ability to estimate data before initial time on the graph

The only major change in rank order of difficulty in skills from the first to the final test was that reasoning was second easiest on the first test.

Conclusions. Third grade pupils normally have little contact with graphs and little effort is made to teach them to interpret graphs.

Third grade children can interpret some types of graphs prior to formal instruction.

There is little difference in difficulty of the selected types of graphs after adequate instruction.

Microfilm \$2.75; Xerox \$7.20. 154 pages.

BEHAVIORAL GOALS OF GENERAL EDUCATION IN THE REGIONALLY ACCREDITED PUBLIC SENIOR HIGH SCHOOLS OF NORTH CAROLINA

(L. C. Card No. Mic 60-6054)

James Braxton Harris, Ed.D.
Indiana University, 1960

Chairman: Virgil E. Schooler

The Problem

The problem was to evaluate the behavioral outcomes desired of and achieved through the general education programs in the regionally accredited public senior high schools in North Carolina as a basis for reaching conclusions concerning the adequacy of such programs and making recommendations, if warranted, for their improvement.

Procedure

Data for the study were collected during the 1958-1959 school year and the early part of the 1959-1960 school year through a personal visit by the writer to each of 20 schools selected at random from among the public senior high schools in North Carolina holding membership in the Southern Association of Colleges and Secondary Schools. The principal, 10 teachers, and 10 senior students from each school participated in the study, making a total of 420 participants.

The evaluation form used to collect data for the study was developed by the Russell Sage Foundation, the National Association of Secondary School Principals, and Educational Testing Service. It contained 99 behavioral

outcomes of general education in high school. On a scale from 0 to 5, each participant in the study rated the importance of each of the outcomes for general education, and the effectiveness of the program of his school in providing for each outcome.

The ratings were regarded as inherently only ranks and were treated with non-parametric statistical techniques. The coefficient of concordance (W) was used to assess the agreement among the three classes of participants in rating the outcomes.

Major Findings

The major findings of the study were as follows:

1. The participants accepted the 99 behavioral outcomes listed in the evaluation form as highly important goals of the general education programs in their schools.
2. The agreement among the ratings of the three classes of participants exceeded that which would be expected to occur by chance alone only one time in a thousand.
3. A majority of the behavioral outcomes ranked highest in importance for general education were in the area of growth toward self-realization.
4. A majority of the behavioral outcomes ranked lowest in importance for general education were in the area of growing in ability to maintain the relationships imposed by membership in large organizations.
5. The participants believed that their high schools ought to do more to create an awareness of, and a concern for, problems of physical and mental health. Other areas in need of strengthening are the conservation of human and natural resources, competence in the handling of money, understanding world problems, using reading skills, and becoming more self-reliant as a person.

Conclusions

The following conclusions were drawn from a consideration of the findings of the study:

1. It is a practicable procedure to translate the goals of general education in high school into observable student behaviors, and to evaluate such programs in terms of their effect on student behavior.
2. While it may not shed light on how to improve general education programs, a study such as this is sufficient to identify the specific behavioral areas in need of improvement.
3. The principals and teachers of the regionally accredited public senior high schools of North Carolina tend to have similar conceptions of the strengths and weaknesses of the general education programs in their schools.

Microfilm \$2.75; Xerox \$6.80. 143 pages.

CHILDREN'S PROBLEMS AS REVEALED IN AUTOBIOGRAPHICAL STATEMENTS

(L. C. Card No. Mic 60-6562)

William David Lewis, Ph.D.
Northwestern University, 1960

The proposal that children are capable of self-analysis in some degree has gained currency among certain contemporary psychologists. Against this background, limited experimentation has been undertaken with a view to establishing the particular contribution which personal documents might make in child study. Autobiographical materials have been solicited and analyzed by teachers at various levels of the educational system. This approach has taken many forms, but is, in considerable degree, justified by an uncritical faith on the part of educators in the utility of such derived information. This exploratory study is predicated on the belief that ego-involved problem statements, obtained from children in the intermediate grades of a midwestern city, can be examined with a view to answering questions that lie in three areas: (1) What are the quantitative aspects of a particular problem distribution? (2) What are the tendencies in problem patterns with regard to the kinds of problems stressed by sub-groups of a pupil population? (3) What effect, if any, do certain common population variables have upon the distribution of critical problems?

In answering these questions, a series of semi-structured story forms are developed; thirty classroom teachers administer these to their pupils, 775 in all, in the intermediate grades of a city school system. Five schools are selected at random; in each school, all classrooms from grades 4-6 participate in the study. Cooperating teachers are trained by the writer to secure responses in a standardized fashion, one within the scope of normal classroom guidance procedures. Responses are then classified and assigned to categories on the basis of consensual decisions by the writer and a team of teacher assistants.

Several thousand "problem stories," obtained in this fashion, then are reduced to twenty major problem areas which, in turn, are distributed among the broader problem designations of the forms: home, school, self, and social. In general, home and school problems receive the greatest stress in pupil writings. School problems are most extensive, but home problems are considered by pupils to be more critical in nature. Statistical variations, as plotted for classrooms, grades, and schools, indicate that variability is greatest on an intra-classroom basis, and is least when expressed as an intra-school comparison. The variable factors of sex and achievement level influence pupil problem patterns only slightly.

The considerable uniformity in problem patterns for the separate schools suggests that shifts in problem tendency are slight at the three intermediate levels of elementary education. The marked variability in the intra-classroom problem distribution reinforces the belief, prevalent among guidance workers, that teachers are indispensable agents in the creation of wholesome climates within the classroom. Home-school relationships, by implication, merit study and improvement if school personnel are to become more effective in aiding children to resolve their difficulties.

Microfilm \$2.75; Xerox \$6.40. 132 pages.

**NON-INTELLECTUAL FACTORS IN EARLY
DISCONTINUANCES OF THE 1959-1960
FRESHMAN CLASS IN ENGINEERING OF
THE PENNSYLVANIA STATE UNIVERSITY**

(L. C. Card No. Mic 61-56)

Raymond Orin Murphy, Ed.D.
The Pennsylvania State University, 1960

STATEMENT OF THE PROBLEM

The problem of this study was to determine the existence of certain non-intellectual factors predictive or descriptive of early drop outs in engineering. Variables chosen for analysis included: The Strong Vocational Interest Blank for Men, the Allport-Vernon-Lindzey Study of Values, the Bernreuter Personality Inventory, and a questionnaire for personal factors including timing of vocational decision, sources of choice influence, certainty of vocational decision, and a group of pre-college experiences thought to be related to career planning.

PROCEDURE

The study, conducted with the 1959-1960 freshman class in engineering of The Pennsylvania State University, matched 167 early drop outs with 167 students who continued beyond the first semester on three variables of aptitude. These included: high school rank, Mathematics 6 Placement Test score, and total score on The Pennsylvania State University Academic Aptitude Examination.

Those who discontinued early ("discontinuants") and those who continued beyond the first semester ("continuants") were further divided into those who achieved above and below a 2.00 first semester average. Eighty-seven students comprised the continuant group with a 2.00 or better. These were defined as "Group I Continuants." Eighty freshmen were included in "Group II Continuants." Thirty-two of those who discontinued achieved a 2.00 first semester average ("Group I Discontinuants") while "Group II Discontinuants" had 135 members.

To determine interest pattern changes, a stratified sub-sample of both groups was re-tested in the spring of 1960.

SUMMARY OF FINDINGS

The Strong Vocational Interest Blank for Men, the Study of Values, and the Personality Inventory were not predictive of early discontinuance.

On the Study of Values, a "t" value of 2.25 existed between Group I Continuants and Group I Discontinuants on the Economic scale in favor of the latter. These discontinuants were also significantly higher ("t" of 2.2) on the Political scale.

After one semester, Group I Continuants increased their letter grade scores in the Science-Engineering grouping of the Strong (chi square of 12.57) and decreased their scores on the Business area with a chi of 21.46.

Group II Continuants lowered their scores for the General Professional and Science-Engineering categories with chi squares of 21.34 and 48.92 as well as Practical scores with a chi of 13.95. They increased their Business and Sales scores with chi squares of 16.43 and 24.53.

Group I Discontinuants lowered their scores for the General Professional (chi square of 31.72); Science-Engineering (chi of 24.57) and Practical (chi of 14.24) while increasing their Social Service scores with a chi of 14.16.

Group II Discontinuants exhibited the greatest fluctuation of Strong scores with a decrease in General Professional (chi of 22.20), Science-Engineering (chi of 129.95), and Practical (chi of 34.15) while increases were established for Social Service (chi of 63.80), Business (chi of 43.89), and Sales (chi of 40.93).

Study of Values re-test scores remained generally constant.

Those who continued rated their high school guidance programs significantly better (chi square of 18.67) and had discussed their career plans more often with their parents (chi square of 6.66). Continuants were initially more certain of their vocational choice (chi square of 32.47) than were discontinuants. Discontinuants ranked their mothers as sources of influence in their career decision significantly more (chi square of 6.89) than did continuants.

CONCLUSIONS

The study concluded: (1) "High scores" on an interest test are not predictive of early success since subsequent experiences affect interest patterns, (2) Early success in engineering training likely reinforces initial choice, (3) Conflicts of basic interests and a developing understanding of engineering may, in part, explain early drop outs, and (4) Career choice is best regarded as a continuous developmental task, an integrated aspect of over-all maturation which can be studied most fruitfully in that light.

Microfilm \$2.75; Xerox \$6.60. 140 pages.

**A COMPARISON OF SELECTED FACTORS
IN THE PRECOLLEGE EXPERIENCES OF
THOSE STUDENTS WHO DROP OUT OF
A TECHNOLOGICAL INSTITUTION AND THEIR
CLASSMATES WHO CONTINUE**

(L. C. Card No. Mic 60-6074)

Merrill Russell Murray, Ed.D.
Indiana University, 1960

Chairman: Philip Peak

This research was concerned with investigating the secondary school experiences, home situations, and other selective factors in the pre-college experiences of the male first year college student and the relationship of these factors to his persistence during the first year enrolled in college.

Procedure

The questionnaire method of gathering data was used to collect the needed information from the students, the parents, and the secondary schools, from which the students had graduated. Replies were received from 421

students, 380 parents and 354 secondary schools. These data were compared by use of the chi-square method of statistical analysis.

Conclusions

From the various factors considered in this study and subsequently found to be favorable or unfavorable to persistence in college some conclusions may be drawn:

(1) The financial resources of the student attending the technological institution are important to their persistence during the freshman year. Annual family incomes above \$10,000 and below \$3,000 seemingly are not conducive to a lengthy stay in the institution studied.

(2) The secondary school officials evaluation of the attitude of the parents toward higher education should be of value as a factor to consider in predicting the student's persistence in the institution.

(3) The secondary school officials evaluation of the students' interest in making plans for college while yet enrolled in high school appears to be of value in predicting the persistence of the student during his first year enrolled at the technological institution.

(4) The earlier the college-going decision is made, the more persistence the student will have in attendance at the institution.

(5) Students who have been administered vocational aptitude tests are more persistent than those who have not received the benefits of a test or tests of this design.

(6) If according to the secondary school officials, most of the students high school friends continued their education after high school graduation the students are less likely to drop out of the institution.

(7) Students with reported intelligent quotients of 130 and above are more likely to remain in college through the freshman year than those with lower intelligent quotients.

(8) The evidence in this research indicate students who are married prior to enrolling in college are more consistent than those who are unmarried when they enroll.

(9) The student who has delayed entering college until five years after high school graduation is a more persistent individual in his endeavors to complete a college education. Microfilm \$2.75; Xerox \$9.25. 201 pages.

A STUDY OF CERTAIN ASPECTS OF EIGHT NATIONAL SCIENCE FOUNDATION SUMMER INSTITUTES FOR HIGH SCHOOL SCIENCE TEACHERS CONDUCTED IN LOUISIANA

(L. C. Card No. Mic 60-5924)

Alwin Parker, Ph.D.

Louisiana State University, 1960

Supervisor: Dr. Sam Adams

The National Science Foundation summer institute program for high school science teachers has grown consistently since its inception. In 1953, two institutes were conducted; and in 1959, 350 institutes were conducted. Eight of these summer institutes were held in Louisiana

(1957-1959). This study was concerned with these eight institutes.

Specifically, this study investigated: (1) the nature of the group selected for participation in the National Science Foundation summer institutes in Louisiana; (2) the programs as they were handled by the colleges and universities; (3) the program as viewed by participating teachers; (4) the program as viewed by principals of the schools in which the participating teachers work; and (5) suggestions for improvement by participating teachers, principals, and institute directors.

Questionnaires were sent to each of 395 participating teachers and 375 principals of schools in which these participating teachers work. From teachers, 162 responses were obtained; and from principals, 137 responses were obtained.

Evaluations and suggestions were obtained from each of the institute directors.

The principal findings of the study are grouped according to the source of the responses:

A. Participating teachers who responded to the questionnaire.

1. 61 per cent had Master's degrees or earned them while enrolled as participants in the program.

2. 82.7 per cent were married, and 30.3 per cent had spouses who earned \$3,000 to above \$6,000 per year.

3. 25.2 per cent showed an increase of interest in professional organizations and publications in science.

4. 50 per cent reported that their teaching assignment had changed after attendance at the institute, with a shift toward a full-time science teaching program.

5. 93.2 per cent believed that they could better motivate students toward careers in science as a result of their attendance at the institute.

6. 99.4 per cent were of the opinion that they were better teachers as a result of their attendance at the institute. They attributed this to an increased knowledge of subject matter in the sciences.

7. 10 per cent indicated that their purpose for attending the institutes was for the money involved; the remainder indicated that their purpose was for professional growth in the teaching of the sciences. They urged the establishment of a central clearing house for applications.

B. Principals who responded to the questionnaire.

91.3 per cent believed that teachers who attended the institutes were more enthusiastic in their teaching and were better teachers because of their participation in the program. They cited increased knowledge in science and ability to make better use of laboratory equipment as being especially valuable.

2. One-half reported that the participating teachers were more active in science fairs, science clubs, and in the utilization of teaching aids as a result of institute work.

They urged expansion of the program into other subject areas.

C. Institute directors.

1. All agreed that the primary objective of the institutes was to improve subject matter competence of participating teachers.

2. All were in agreement that presentation of course work in scientific subject matter was the way to approach the objectives of the National Science Foundation summer institute program.

Recommendations were:

1. Certifying agencies in the states should require more course work in science areas for those who have selected these fields of teaching.
2. Geographic regional summer institute programs should be set up with vigorous subject matter objectives and in cooperation with certifying agencies so that to keep certification valid, teachers would be required to attend these institutes at prescribed intervals.

Microfilm \$2.75; Xerox \$4.20. 76 pages.

AN ANALYSIS OF THE PLANS FOR
POST-SECONDARY EDUCATION OF 1959
SECONDARY-SCHOOL SENIORS IN
CONNECTICUT AND CERTAIN FACTORS
WHICH INFLUENCE THESE PLANS

(L. C. Card No. Mic 60-5247)

Alexander Joseph Plante, Ph.D.
The University of Connecticut, 1960

STATEMENT OF THE PROBLEM

The purpose of this study is: To make an analysis of the plans for post-secondary education, and the factors which influence these plans, for the 1959 seniors in Connecticut secondary schools.

SCOPE OF THE PROBLEM

The study is concerned solely with the plans of 1959 seniors in secondary schools of Connecticut. Public-secondary schools, independent-secondary schools, and technical-secondary schools were included.

PROCEDURES EMPLOYED

The major steps of the study were:

- Step I - To develop a list of factors thought to be influential on the plans for post-secondary education of secondary-school seniors in Connecticut.
- Step II - To secure information about the post-secondary plans of Connecticut secondary-school seniors and the factors influencing their decisions. A total of 2239 secondary-school seniors from 24 secondary schools participated.
- Step III - To obtain from secondary-school officials certain additional information concerning the secondary-school seniors who participated in this study.
- Step IV - To tabulate, record, and interpret the data concerning the post-secondary plans of participating seniors in terms of the factors which might affect these plans. The data were analyzed as follows:
 - a. Social class
 - b. Type of secondary school
 - c. Intelligence-quotient scores
 - d. Rank in class
 - e. Seniors accepted by a post-secondary institution
 - f. Seniors planning to attend a post-secondary institution but not going

- g. Seniors not planning to attend a post-secondary institution and not going.

CONCLUSIONS

1. It is apparent from the findings in this study that there is a definite relationship between the type of secondary school of seniors and their plans to attend, their application to, and their acceptance by a post-secondary institution.
2. The social class of seniors apparently influences their plans for post-secondary education and their eventual acceptance by a post-secondary institution. Furthermore, the social class of seniors influences the type of post-secondary institution by which they are accepted, the location of the post-secondary institution, and its classification of "private" or "public."
3. Apparently there is a relationship between the intelligence of seniors and their plans for and acceptance by a post-secondary institution. In addition, seniors of higher intelligence are more likely to attend a "private" four-year college or university.
4. With rare exceptions, the highly capable seniors of Connecticut plan to attend and are accepted by post-secondary institutions.
5. Of the seniors accepted by post-secondary institutions, the largest proportion is accepted by four-year colleges or universities.
6. The desire for occupational training is the major reason why Connecticut secondary-school seniors want to secure post-secondary education. It is true that many seniors desire general knowledge as a reason for securing post-secondary education, but this reason clearly ranks second to the desire for occupational training.
7. The reasons most frequently given by seniors for not continuing their education are: (1) plans to enter the armed services; (2) financial problems; (3) desire for a job which does not require further education; (4) lack of interest in further education; and (5) the feeling that they would not be accepted.
8. Teaching is the occupation preferred most frequently by seniors accepted by post-secondary institutions. However, teaching is not the occupation preferred most frequently by the highly intelligent seniors accepted by post-secondary institutions.
9. Engineering and physical and earth science occupations are preferred most frequently by seniors of high intelligence. Agricultural occupations and trades and industrial occupations are preferred most frequently by seniors of middle or lower intelligence.
10. The two-year junior college or business school ranks second, but far below, the four-year college or university as a means of post-secondary education for Connecticut seniors.
11. According to this study, the students in three-year nursing schools and post-secondary technical or trade schools are from the middle or lower social classes.

Microfilm \$2.75; Xerox \$8.40. 182 pages.

LEGAL OPINIONS AND COURT DECISIONS
AFFECTING PUBLIC EDUCATION IN
ALABAMA, 1926 TO 1960.

(L. C. Card No. Mic 60-5856)

Lloyd Franklin Posey, Ed.D.
George Peabody College for Teachers, 1960

Major Professor: Arville Wheeler

The purposes of this study were:

1. To compile and group all the Alabama cases reported under "Schools and School Districts" which were reviewed by the superior courts during the period 1926 to 1960.

2. To analyze the cases for common causes and trends.

3. To present the findings in a frame of reference consistent with current educational theory and practice related to efficient planning and operation of Alabama schools.

The findings were based on the 101 cases which resulted in approximately 130 decisions during the period of the study.

1. The courts of appeal in Alabama are consistent in their decisions of cases involving similar basic principles of school law.

2. Financing schools has been the cause of the greatest number of cases.

3. Court decisions are sought increasingly for a period of time following any new statute or constitutional amendment which increases school taxes.

4. Regarding powers of school boards, the question occurring most frequently was the method of transfer or dismissal of teachers.

5. Causes of litigation are: testing the constitutionality of acts of the legislature, general ignorance of the law, vagueness of statutes, especially those having local application only, failure to record actions of boards, and failure to observe the law in steps necessary for calling school tax elections.

Broad principles of law followed by the courts were:

1. The legislature has plenary power in establishing and maintaining schools.

2. The courts will not substitute their judgment for the judgment of local boards in their discretionary powers unless there exists fraud, bad faith, or abuse of discretion.

3. The court recognizes the supremacy of the legislature over decisions of the court except in acts which the court may hold to be unconstitutional or incapable of operation.

4. Tort suits against board for negligence of employees of the board are not permitted.

5. The power to tax is the prerogative of the state and district bodies hold only such power as is delegated to them by the legislature.

6. All persons are held to know the law.

The recommendations were as follows:

1. State departments of education should conduct in-service institutes for members of boards of education, publish handbooks of law, and law letters.

2. County and city boards of education should budget funds for informational material, for attendance at institutes, and for periodic consultative consideration of basic legal principles of school law. Definite board policies

should be adopted, printed, and placed with all employees of the board.

3. Boards should carefully record their actions in formal minutes of each meeting.

4. All professional groups in education should promote legislation calculated by standards of modern educational theory to improve education in Alabama. An item for consideration is a constitutional amendment which would provide that no county governing body or official could be removed from office or the office abolished by legislative enactment without the act first being submitted to a vote of the people of the political division affected.

Microfilm \$4.55; Xerox \$16.00. 354 pages.

INTERMEDIATE GRADE PUPILS' OPINIONS
ABOUT DISCIPLINARY PRACTICES TEACHERS
COMMONLY EMPLOY IN MEETING
CLASSROOM BEHAVIOR ANNOYANCES

(L. C. Card No. Mic 60-6088)

Robert Alfred Sylwester, Ed.D.
University of Oregon, 1961

Adviser: Donald E. Tope

This study proposed to explore intermediate grade pupils' opinions about disciplinary measures teachers commonly employ when annoyed by pupils' behavior. Seven hundred and fifty pupils from grades four, five, and six of the Eugene, Oregon, Public Schools participated as respondents in the three phases of the study.

Phase One. - Pupils were asked to list classroom behaviors which annoyed their teachers.

Phase Two. - Behavior incident portraits were written describing fifteen of the most frequently mentioned annoying behaviors. Pupils were asked to write what their teachers usually did when confronted with these annoying behaviors.

Phase Three. - The disciplinary measures most frequently associated with each of the fifteen annoyances were selected. Pupils were asked to judge the fairness and effectiveness of each measure as used in the particular annoying situation. They were also asked to write how they would meet each situation if they were the teacher. Group interviews were held with selected groups of pupils to further explore their opinions about questions raised during the study.

Major Findings

1. Twenty-three categories of annoyances were developed from pupils' lists. Each of the following behaviors was mentioned by at least 20% of the pupils: talking, being impertinent, being indifferent to assigned schoolwork, engaging in improper out-of-seat activities, being noisy, playing, not paying attention, bothering the teacher, interrupting, and seeking attention.

2. Pupils indicated that teachers employed relatively few general types of disciplinary measures in meeting the majority of annoyances, although they described forty-one specific measures. Seventy-three percent of the statements describing teacher treatment of fifteen annoying

situations were classified into four more general categories of disciplinary measures: teacher makes a simple request, teacher removes pupil from area of annoyance, teacher deprives, and teacher verbally censures pupil.

3. Of twenty-five specific disciplinary measures associated with the fifteen annoying behaviors, pupils judged only spanking unfair. The percentage of pupils judging a measure as fair was generally higher for the less severe measures.

4. Seven of the twenty-five measures were considered usually ineffective: asks pupil to behave, sends pupil to his seat, changes pupil's seat, sends pupil to the corner, refuses help when requested, puts pupil's name on list, and scolds pupil.

5. An inverse relation between fairness and effectiveness was found. The rank-order correlation was $-.52$.

6. The more rarely used, more severe, and less predictable measures were generally considered the most effective.

7. When suggesting best approaches to the fifteen annoying situations, pupils tended to mention the same measures they had reported their teachers used.

8. Statements and opinions of pupils classified by sex, grade, and behavior showed much more agreement than disagreement.

Conclusions and Implications

Teachers' disciplinary practices, though not considered particularly effective or ineffective in themselves, are well established and seem accepted by children. This background of tradition establishes a framework within which teachers may work when dealing with most classroom behavior annoyances.

In treating specific annoying situations, however, teachers' practices influence the development of values fostered in our democratic society. Thus, it seems pertinent for teachers to consider the effect of the common disciplinary measure upon the specific annoying situation, child, and classroom. While the majority of children might consider the teacher's actions as fair, there is need for concern about the minority who consider it unfair.

Although some differences emerged when comparisons were made of opinions expressed by pupils divided according to sex, grade, and behavior, generalizations regarding treatment of behavior on this basis are not warranted by the findings of this study. It would seem that the teacher must look to understanding of the individual child for guidance in dealing with his behavior.

This suggests that effective classroom control is dependent upon good pupil-teacher relations. The study indicates that teachers can use pupils' opinions in gaining an understanding of the effectiveness and fairness of his procedures in dealing with pupils' behavior.

Microfilm \$2.75; Xerox \$8.40. 183 pages.

A STUDY OF TWELFTH GRADE SOCIAL STUDIES IN THE WHITE ALABAMA HIGH SCHOOLS

(L. C. Card No. Mic 61-237)

James Robert Thomson, Jr., Ed.D.
University of Alabama, 1960

It was the purpose of the study to determine the courses being offered and the topics studied in twelfth grade social studies in the white public high schools in Alabama and to gather other pertinent information concerning the teaching of these courses.

The data for the study were obtained from a questionnaire mailed to 300 teachers of twelfth grade social studies whose names were supplied by the county and city superintendents. Of the 300 forms mailed, 169 useable ones, or 56 per cent, were returned.

From the study the following conclusions were drawn:

1. The twelfth grade social studies curriculum is composed principally of economics and government as follows: 34.8 per cent economics, 47.9 per cent government, 7.5 per cent problems of democracy, 2.6 per cent home and family problems, 1.3 per cent psychology, and 5.9 per cent miscellaneous.

2. It cannot be determined from the name of a course what is actually taught.

3. Most schools use the state adopted textbook.

4. The typical course is taught for one semester.

5. Students other than those in the twelfth grade may take the twelfth grade courses in some instances.

6. It would seem that most of the teachers fitted the course to the particular situation since units other than those in the textbook were studied.

7. Though the teachers do not use one teaching method exclusively a majority use the discussion method and textbook method.

8. In a majority of the cases the students participate in the selection of some of the topics to be studied.

9. Most teachers are assisted by some outside agencies.

10. A little less than one-half of the teachers require the students to subscribe to a periodical for class use.

11. The teachers use many instructional materials in their teaching.

12. While several factors are used in arriving at students' grades, tests and classwork play the most important parts.

13. All schools have a library and most of them have the open-shelf arrangement. However, a lack of classroom libraries was reported. Most of the teachers have a part in choosing books for the school library but do not have access to a catalog of current pamphlets.

14. A great majority of the teachers teach courses other than twelfth grade social studies.

15. All of the teachers indicated a bachelor's degree with 49 per cent holding the master's degree.

16. A majority of the teachers have over 13 years total teaching experience but over 50 per cent have less than 6 years experience teaching twelfth grade social studies.

17. Over 50 per cent of the teachers have participated in work other than teaching.

18. The teachers belong to several organizations, with professional, religious, and school organizations being the primary ones.

19. As a general rule the teachers of twelfth grade social studies do not subscribe to professional journals.

20. Most of the teachers indicated that they thought it best that the State Department of Education not outline the subject matter to be covered.

21. A textbook is desired by a majority of the teachers.

22. Over 50 per cent of the teachers think that American history and civics should be pre-requisite subjects for twelfth grade social studies.

23. Most of the teachers are not satisfied with the equipment which they have for teaching twelfth grade social studies. The teachers in small schools listed their greatest needs to be: more supplementary reference books, more auditory and visual aids, and more adequate library facilities. The teachers in medium and large schools listed more supplementary reference books, smaller classes, and more auditory and visual aids.

Microfilm \$4.00; Xerox \$13.95. 309 pages.

A STUDY OF THE SCIENCE KNOWLEDGE AND BACKGROUNDS OF SELECTED ELEMENTARY TEACHERS AND COLLEGE STUDENTS

(L. C. Card No. Mic 60-5522)

Clarence Earl Williams, Sr., Ed.D.
Texas Technological College, 1960

Chairman: G. P. Mecham

Science background data sheets and science inventories were administered to eight hundred elementary public school teachers and two hundred college seniors who were majoring in elementary education. Data obtained from this sampling were subjected to statistical analysis to determine the relationships between certain factors of past science experiences and present science knowledge.

The first factor considered in relation to science inventory scores was the number of science courses studied in public schools. Correlation coefficients between these two items were .00 for teachers and .04 for college seniors. Eta coefficients were .20 and .19 for teachers and students respectively, with eta for teachers significant at the .01 level. The F test for linearity indicated that eta coefficients as large as these could be expected from sampling errors for both teachers and students.

Relationships between science inventory scores and science courses completed in college were explored, and correlation coefficients between these items were .16 for teachers, significant at the .01 level, and .11 for college seniors, significant at the .05 level. The eta coefficient for teachers was .19, significant at the .01 level, and for students, .28, significant at the .05 level. An eta as large as .19 for teachers could be expected to occur due to sampling error, but for college seniors, the regression could not have been due to sampling error and the eta coefficient could be accepted with confidence.

Correlations between scores on the science inventory and individual science study showed point-biserial correlation coefficients of .13 for teachers, significant at the .01 level, and .12 for college students, not acceptable at the usual levels. Between science inventory scores and viewing science programs on television, the point-biserial

correlation coefficients were .07 for teachers and .00 for college students. There appeared to be a small, but definite relationship between individual science study and science inventory scores, but little or no relationship between viewing science programs on television and scores on the science inventory.

Science inventory mean scores of elementary teachers, college seniors, and public school sixth grade pupils were highest on the part of the inventory dealing with conditions necessary to life. Sixth grade pupils scored lowest on the section covering living things; elementary teachers and college students scored lowest on the section about the universe. Mean scores of sixth grade pupils roughly paralleled those of teachers and college students on questions about the earth and conditions necessary to life. Mean scores of pupils were relatively higher on the part about the universe, and were relatively much lower on the parts dealing with living things, physical and chemical phenomena, and conservation. It was concluded that pupils might be learning about the universe to some extent outside of school, and that they were not receiving as much knowledge about living things, physical and chemical phenomena, and conservation as might be desirable in an elementary classroom.

Critical ratios for differences between the mean scores of teachers and college students were not significant; between teachers and sixth grade pupils, and between college students and sixth grade pupils, critical ratios were very significant.

Correlations between the grade taught and science inventory scores showed a definite relationship: for teachers, .49, not significant at customary levels, and for students, .91, significant at the .01 level. Teachers of higher grades tended to score higher, and teachers of lower grades tended to score lower on the science inventory. It seemed probable that science knowledge was somewhat related to the grade level taught.

Microfilm \$2.75; Xerox \$3.00. 50 pages.

AN INVESTIGATION OF THE STATED REASONS WHY SOME TEACHERS LEAVE SCIENCE TEACHING, WHERE THEY GO, AND HOW THEY MIGHT HAVE BEEN RETAINED.

(L. C. Card No. Mic 61-530)

Ernest George Wise, Ph.D.
Syracuse University, 1960

Purpose

This study is an attempt to learn why the science teachers in high schools are leaving science teaching; where they go; and what could be done to retain them. High school science teachers are in a position to be the inspiration and guiding force needed to steer greater numbers of our youth into careers of science and engineering. This is a function that is most important during our "Cold War" scientific struggle with the Soviet Union. Unfortunately the quantity and quality of the current high school science teacher leaves much to be desired.

Methodology

Three questionnaires were developed to obtain data related to the problem. One questionnaire was sent to science teachers who had left science teaching in Upstate New York between September 1, 1953 and August 31, 1956. Two questionnaires, the principals' and current science teachers', were sent to a stratified random sample of public schools in upstate New York during May through September, 1957.

Questions relative to the status of science courses, science teaching, and science teachers, along with the reasons for leaving, their new occupations, and methods of science teacher retention were asked.

Major Results and Conclusions

The personal data asked of the former and current science teachers revealed that four out of five were married and that men dominate science teaching in numbers yielding that same ratio. The former science teachers were younger, but curiously had a higher mean number of children.

Approximately ninety-nine percent of the science teachers have had four or more years of college. Unfortunately less than half are graduates of teacher preparatory curricula. Graduates of liberal arts curricula almost equal the teacher preparatory graduates.

The liberal arts and other specialized curricular groups felt a particular need for professional and science education courses. The advisability of an adequate practice teaching experience was frequently expressed. In respect to science content courses, a broader science background was the most general felt need.

Since three out of four current science teachers are graduates of liberal arts institutions, the greatest responsibility rests with these institutions in their advising programs and in their curricula.

Four fifths of the teachers enjoyed science teaching but less than half thought of it as a terminal goal. Their goals were other positions in education. Only one out of twenty indicated a business or industrial goal.

The loss of science teachers is primarily due to the brighter future in other areas of employment and inadequate salaries. Furthermore, increased salaries were specified as the major factor needed to retain the current science teachers and for the return of former science teachers.

Factors related to working conditions rated low as primary reasons for leaving, but showed a high rating as third choice reasons and in the comments. Their importance may be greater than revealed by the data. Unsatisfactory community conditions were designated as present, but they were not given as reasons for leaving science teaching.

The data and comments revealed the immediate need for a great many improvements. These improvements are modest and most realistic when compared to the status of other professions and with what labor unions have obtained for the non-professional worker. Gains must be granted in salary and working conditions if the exodus from science teaching is to be stopped. These would help to eliminate the shortage of science teachers, both in number and in quality. Only by the elimination of our science teacher shortages will our youth be adequately educated in science

for their citizenship responsibilities and for the stimulation needed to increase their desire for a scientific or engineering career.

Microfilm \$6.15; Xerox \$21.85. 482 pages.

EDUCATION, ADMINISTRATION

RELEVANCE OF CONNECTICUT'S FINANCIAL ABILITY TO ITS FISCAL EFFORT FOR THE SUPPORT OF PUBLIC EDUCATION

(L. C. Card No. Mic 60-5217)

Thomas Anthony Aquila, Ph.D.
The University of Connecticut, 1960

The central issue of this paper was to examine the relationship between Connecticut's economic ability and the level of income allotted to support its public school system.

As to economic ability, this study found that Connecticut's financial leadership was incontestable. Few states enjoyed the supremacy of wealth which permitted its people to earn, to spend, and to save more income than residents of almost all other states.

Fortunately for Connecticut, this wealth was not dissipated by an unwieldy educational burden. For example, in terms of the number of children to educate, number of professional personnel to staff schools, and number of classrooms to house students, Connecticut, in comparison to many other states, had a small educational load.

Yet despite the fact that Connecticut had most of the wealth and an educational system whose size is among the least burdensome, there were aspects of its educational attainment which bordered mediocrity. Although this paper does not pretend to evaluate the quality of public education in Connecticut, there was sufficient evidence to indicate that its fairly good school system was far from achieving favorable results for all youth.

Better schools, however, are more expensive schools. Well meaning critics can justly claim that Connecticut's educational bill in total dollars was larger than ever before. Recently increased school revenues, however, did not reflect the fact that the percentage of personal income allotted for educational purposes was not appreciably greater than thirty years ago. Similar school finance problems faced other states as well as Connecticut. Nevertheless, states with less fiscal ability, and with heavier educational loads, made a greater financial effort for the support of public education than Connecticut. The people of these states, willingly taxed themselves to a greater extent so as to provide more of their personal income for school purposes.

Thus in summation, the problem confronting Connecticut is not if it can afford good education for all children, but whether the people are willing to pay for better schools. On one hand there is a strong desire for high educational ideals. On the other hand a relatively low level of financial support is provided for the attainment of these ideals. This contrast reflects some confusion between essential and non-essential spending, between

responsible and irresponsible citizenship. Probably a deeper sense of purpose is needed before a higher priority will be given to public education. This much, however, is certain. Connecticut must choose between fair education and good education for all youth. To provide good public schools for some, satisfactory schools for many, and inferior school for others is incompatible with our way of life.

Microfilm \$2.75; Xerox \$7.40. 160 pages.

AN ANALYSIS OF THE INTELLECTUALLY SUPERIOR HIGH SCHOOL SENIOR IN THE SALT LAKE CITY SCHOOLS, 1957-1958.

(L. C. Card No. Mic 60-6221)

Ralph Vernon Backman, Ed.D.
University of Utah, 1960

Chairman: Paul C. Fawley

I. THE PURPOSE AND SCOPE OF THE STUDY

It was the purpose of this study to determine through an inventory, the extent to which superior seniors in Salt Lake City were measuring up to their potential in several identifiable areas of school achievement: academic and non-academic subjects, attendance, and grade-point average.

II. METHOD AND SOURCES OF DATA

Cumulative records of the seniors at East, South, and West high schools, identified in the upper 15 per cent of their classes through aptitude tests, served as the primary source of the data. Additional information on student population and the school-community was obtained from the Kellogg studies of 1956.

An inventory of subjects taken was made of the group representing each school. Total groups (boys and girls separately), college, and non-college groups were studied. Comparisons were made between the comprehensive schools, South and West, and the suburban school, East.

III. CONCLUSIONS

1. The training of a special group of children because of their individual characteristics is consistent with our democratic ideal of equal opportunity for all.
2. Socio-economic factors play an important role in the educational aspirations of youth.
3. The community's attitude toward the schools plays a great part in the effectiveness of an educational program.
4. There must be a departure from traditional curricular practices if we are to gear the schools to the age of science.
5. Occupational and educational intentions of youth should be considered in planning the curriculum.
6. The Salt Lake City high school population is a stable one.
7. Salt Lake City students fall short of Conant's recommendations in several categories.

8. There should be a sufficient number of periods in the day to enable the student to pursue a balanced program.
9. There is need for additional curricular aids and professional personnel.
10. The upper 5 to 10 per cent of the students in the three schools are very similar.

IV. RECOMMENDATIONS

It is recommended that:

1. The central administration assumes the initiative in interpreting the programs of the schools to the public.
2. Citizen groups assist with curriculum revision in each of the schools.
3. There be a statement of the philosophy of education to which the Board of Education subscribes.
4. All children be given the opportunity to develop their unique talents.
5. There be an immediate increase in the guidance services in the high schools.
6. There be a periodic evaluation of the curricular offerings of each school.
7. A study be made of attendance practices as they apply to the academically talented.
8. Provision be made for a developmental reading program in each school.
9. An evaluation be made of those areas in which schools fall short of the Conant recommendations.
10. The academically talented girls in all schools be encouraged to take more challenging programs.

V. SUGGESTED AREAS FOR FURTHER STUDY

1. How much do the patrons of our schools favor Conant's recommendations relative to the academically talented?
2. Does the present seven-period program in Salt Lake City accomplish the objectives for which it was purportedly established?
3. How much demand is made of the academically talented in extra-curricular activities and community services?
4. To what extent are the cultural interests of parents a factor in the academic success of their children?
5. To what extent are women acceptable in the professions usually reserved for men?
6. Why do certain academically talented students not attend college?
7. How can an evaluation be made of the climate under which the academically talented are educated?
8. Should we subscribe to a program of more specialized vocational courses within the framework of the comprehensive high school?
9. What are the reasons for the apparent excessive absences among the academically talented?
10. What techniques should be developed for helping students make appraisals of themselves in the light of their capacities?

Microfilm \$6.40; Xerox \$22.75. 504 pages.

**A CRITICAL ANALYSIS OF THE DEVELOPMENT
OF A CLOSED-CIRCUIT MICROWAVE
TELEVISION NETWORK FOR ELEVEN
COLLEGES AND UNIVERSITIES IN THE
CENTRAL TEXAS AREA**

(L. C. Card No. Mic 60-6604)

Joe Allen Bailey, Ph.D.
The University of Texas, 1960

Supervisor: Dr. C. C. Colvert

This study was a critical analysis of the developmental phase of a closed-circuit educational television network, a joint project of the United States Office of Education, The University of Texas, and ten other Central Texas colleges and universities. Funds for programming were provided by the Fund for the Advancement of Education. Data were gathered through the use of personal interviews, inspection of the records of the project and close observation of the activities as they developed. Each of the major contributing factors to the project was analyzed in detail and a chronological list of the developments was compiled along with explanatory comments on each event.

The proposed network would have connected the eleven institutions of higher education by a closed-circuit microwave television network extending approximately one-hundred miles in length from Georgetown in the North to San Antonio in the South. Program material would have been transmitted into the system from The University of Texas in Austin or from the commercial television stations in San Antonio. It was anticipated that the system would carry from eight to ten full credit courses pre-recorded on videotape. The use of the videotape was to be one of the unique technical features of the project.

The cooperating colleges of the project consisted of city, state, and church related institutions, varying in size from about five-hundred students to above eighteen thousand students. The objective of the first phase of the project was to determine whether these differences could be reconciled, the engineering problems worked out, and a satisfactory program of courses and evaluation procedures developed.

The findings of the research indicated that the colleges cooperated extremely well. There were fewer problems of course planning, textbook selection and scheduling than had been anticipated. The first phase accomplished its desired objectives of establishing a framework for the system's operation and working out engineering details. An application for construction was filed with the Federal Communications Commission. Programming was well underway.

The developmental phase of the project demonstrated: that colleges of different religious affiliations could work together; that large and small colleges could cooperate on a joint project without the small schools losing their identity; that there was not much basic difference in the course offerings of Central Texas colleges; that equipment problems were more a matter of choice rather than availability; that new and better equipment would be available for which a present system could be engineered; that faculty members were somewhat opposed to an educational television network; that administrators were generally for the project; that programming difficulties were greatest in the area of scheduling; that manufacturers were helpful

in designing a system to fit within the budget; that participating colleges expected different returns from the project; that governing boards were not greatly interested in how schools spent minor amounts of money; that Central Texas citizens apparently approved of educational television; that professional educators were not convinced that educational television was a "proven success"; that the planned network operated by closed-circuit microwave television was practical from an engineering standpoint and manufacturers would submit a firm construction price; and that further development of such a network seemed justifiable.

Microfilm \$3.90; Xerox \$13.75. 301 pages.

**A STUDY OF INFORMAL GROUP
ACTIVITY WITHIN A COMMUNITY'S
EDUCATIONAL ARENA**

(L. C. Card No. Mic 60-6077)

William D. Barnes, Ed.D.
University of Oregon, 1961

Adviser: Dr. Donald E. Tope

Statement of the Problem

This study was an examination of the informal relationships by which school-oriented leaders influenced significantly the development of policy in the educational arena of an Oregon community. Basic problems derived from the main problem directed the investigation and subsequent reporting of data. These were: Who were the school-oriented community leaders? How did they relate themselves to each other? In what types of policy formation did they become involved? What practices did they employ in these policy forming situations?

In any community it appears that there are some individuals who exercise a disproportionate amount of influence in the development of local policies. The general public, on the other hand, tends to be quite removed from the policy forming process; and, in fact, large segments thereof fail to exercise their franchise in local electoral matters. The study proceeded on the assumption that some community influentials become concerned with, and are active in, various matters within the local school arena. These individuals were referred to as school-oriented community leaders. This study was undertaken in the belief that the informal activities of this population could be studied and described and that the descriptions might provide useful insights into the leaders' behavior.

Approach to the Problem

The field study approach was utilized since it permitted the observation and study of the selected population under a variety of circumstances within its social context over an extended period of time as well as a study of various relevant documentary materials. The study was ultimately delimited to include fifteen businessmen and professionals who were nominated as community leaders by many other individuals in the community and who were also recognized as being influential in local school matters. As the work

proceeded it became increasingly apparent that the leaders under study were relating themselves to each other in special ways which suggested groupings of an informal nature. Consequently, certain elements of group theory were drawn upon to develop indicants of group existence, to apprehend the leaders' activities within the group context, and to analyze the observed behaviors.

Groups In Action

The members of the school-oriented leadership population were identified as belonging to one or another of four informal groups. One group, composed of businessmen, represented the economic dominants of the community who for years had exercised hegemony over the local political arena, usually by informal means. This group manifested a real concern for the financial management of the school district.

A second group, comprised largely of young professionals, had come into prominence in the community in recent years. Its members were concerned with improving municipal services. They admitted to a certain predilection for "picking up controversial issues" and working on them. Their intent was to foster policies which would have beneficial and enduring consequences for the general public.

A third informal group was made up of several friends who regularly hunted and fished together. All but one of this group held official positions in the school district.

The two leaders in the fourth group, a pair relationship between the new superintendent of schools and the local newspaper editor, were friends of long standing. They had known each other in another community.

Conclusions

The study included nine conclusions. In these, note was taken of the important anchorings groups provided the school-oriented leaders, the shift in political domination of the community as the young professional group took over from the older businessmen group, and the difficulties this power shift occasioned for the veteran superintendent of schools as the young professionals made demands on him. It was observed that the superintendent's difficulties were related to his rigidity in role behavior in the face of change, as he persisted in patterning his actions with reference to the perspectives of the businessmen group. His successor developed far more flexibility in role behavior, utilizing numerous groups as referents for his policies and practices. Finally, it was concluded that the complex social situations confronting school administrators in their various communities make it important that they have well developed understandings regarding the structural properties of communities. This has important implications for the colleges and universities that train school administrators.

Microfilm \$2.75; Xerox \$8.00. 175 pages.

A STUDY OF THE RELATIONSHIP BETWEEN THE ADAPTATION OF CERTAIN PRACTICES IN LOCAL PUBLIC SCHOOL ADMINISTRATION IN VIRGINIA AND PUPIL ACHIEVEMENT IN READING

(L. C. Card No. Mic 60-6601)

Ben Gess Bosworth, Jr., Ed.D.
University of Virginia, 1960

It was the purpose of this study to determine the relationship between the introduction and diffusion of certain practices in Virginia school systems and pupil achievement in reading. The study was undertaken to gain insight into the relationship of administrative adaptability to pupil achievement in reading. Adaptability was defined as the capacity for sloughing off outmoded purposes and practices and taking on new ones to meet new needs.

Literature was surveyed to trace the development of the concept and to determine the factors most influencing administrative adaptability.

Means of measuring administrative adaptability were developed, utilizing introduction dates and diffusion of several desirable administrative practices. These practices were: special classes for mentally handicapped children; twelve year school organization; professional libraries; free textbooks; standardized pupil permanent records; consolidation of smaller schools; use of district-owned school buses; use of visiting teachers; use of supervisory personnel; central purchasing of supplies and equipment; use of lay advisory boards; employment of certified teachers; central recruitment and employment of custodians; adult education programs; providing school clerical help; and providing work experiences for pupils.

Questionnaires to determine dates of introduction and diffusion of the practices were sent to all Virginia public school superintendents.

The reading achievement of pupils was determined with test results supplied by the Virginia State Board of Education. This agency in 1957 administered the Iowa Silent Reading Test, Elementary Test, to all eighth grade pupils in Virginia and test results were available for most of the local school districts. This test had general acceptance in reading literature as a good indicator of reading achievement.

No way existed to combine white and Negro test results, so each system's median standard score for white children was taken to indicate pupil reading achievement for that system.

The selected practices were then compared with pupil reading achievement. The findings were as follows:

1. There was a positive correlation of .18 between administrative adaptability, as represented by the dates of introduction of selected practices, and pupil reading achievement in county school systems.
2. There was a positive correlation of .27 between administrative adaptability, as represented by the degree of diffusion of selected practices, and pupil reading achievement in county school systems.
3. There was a positive correlation of .03 between administrative adaptability, as represented by the dates of introduction of selected practices, and pupil reading achievement in city school systems.
4. There was a positive correlation of .16 between administrative adaptability, as represented by the degree of

diffusion of selected practices, and pupil reading achievement in city school systems.

5. Practices were most often pioneered or followed at an early date by county systems within the highest quartile of pupil reading achievement. However, pioneering and early following also took place within county systems at all levels of pupil reading achievement.

6. Pioneering and early following of practices took place within cities in all quartiles of pupil reading achievement.

7. The higher the degree of pupil reading achievement in county school systems, the more likely the system was to produce relatively high diffusion of the practices.

8. The degree of diffusion of practices within city school systems was almost uniformly high for all quartiles of pupil reading achievement.

Microfilm \$2.75; Xerox \$7.00. 149 pages.

AN EMPIRICAL EVALUATION OF FIVE TESTS FOR ADMINISTRATOR SELECTION: THE COMPOSITE STUDY.

(L. C. Card No. Mic 60-6700)

Richard Dudley Boyce, Ed.D.
Stanford University, 1960

Statement of the Problem

The Pacific Southwest Regional Center of the Cooperative Program in Educational Administration at Stanford University has been engaged in a program concerned with the identification and training of future school administrators; it is currently endeavoring to select and standardize a test battery to assist in the initial screening of administrative candidates. This investigation is one of several undertaken to examine statistically the validity of certain tests included in this battery. Instruments studied are: the Miller Analogies Test (MAT), Minnesota Teacher Attitude Inventory (MTAI), F-Scale (POQ), Allport-Vernon-Lindzey Study of Values (SV), and Edwards Personal Preference Schedule (EPPS). The criterion instrument employed is the Purdue Rating Scale for Administrators and Executives.

In proposing this study it was hypothesized that:

- significant relationships would exist between certain variables of the test battery and the criterion instrument;
- high success administrators would obtain significantly different scores, from those earned by less successful administrators on the test variables;
- a pattern of characteristics, attributable to a modal successful administrator, would be found among variables;
- similar results would be obtained in each of three companion studies investigating, independently, five metropolitan area public school districts.

Research Design

This study investigated a composite of three suburban community samples; two companion studies each investigated larger city district samples; each used methodological processes common to all. A test of variability among districts of this study precluded identification of a

metropolitan area matrix, as well as an amalgamation of the samples of this study.

Forty-one participants were drawn from among elementary school principals of three districts having differing organizational, financial, and administrative characteristics, in communities having distinguishable socio-economic and demographic identities.

Each client was administered five tests and rated by three superordinates of his own district. Selection of raters was based on relatively equal opportunities for gaining insightful and unbiased judgments. Test scores were correlated with the success criterion, using Pearson product-moment coefficients of correlation. Each group of principals was divided into high success and low success groupings, based on median ratings on the criterion instrument. Means for each test were obtained, scores earned by the high success group were compared with those of the low success group, and the significance of differences was determined.

Findings

The significant (.05 level) Pearson r 's obtained were as follows: In separate districts, the (MTAI) and Autonomy, Intraception, and Change scales of the (EPPS) correlated negatively, and the Aesthetic and Religious scales of the (SV) and the Abasement and Nurturance scales of the (EPPS) correlated positively, with the success criterion. Neither the (MAT) nor the (POQ) was significantly related to criterion scores.

Interpretations drawn from the analysis of differences between the means did not allow for the modal identification of the more successful and less successful principals. Significant differences were found between groups on the (MAT) and the Aesthetic scale (SV) in one district. Another yielded differences between groups based on Autonomy, Nurturance, and Change (EPPS). In each case the less successful principals obtained the higher scores.

An analysis of variance among characteristics, ratings, and test scores of clients from the three district samples revealed that variability among districts exceeded that among individuals within districts.

Conclusions

The scales listed above are generally useful as measures for screening potentially successful school administrators. The variability among district performances suggests that distinctive identities attributable to metropolitan communities permeate their school systems as well. It is recommended that selection procedures should be directed at situational factors which may affect both performance and criteria determination.

Microfilm \$2.75; Xerox \$9.45. 208 pages.

CERTIFICATION REQUIREMENTS FOR ELEMENTARY-SCHOOL PRINCIPALS IN THE UNITED STATES AND PUERTO RICO

(L. C. Card No. Mic 60-6641)

Bill Bernice Bryant, Ed.D.
The University of Texas, 1960

Supervisor: Dr. Henry J. Otto

The problem of the study was an analysis of a major part of the requirements for the certification of the elementary principal in the fifty states and Puerto Rico. An analysis was made of minimum requirements in general education, undergraduate professional education, and graduate professional education. The data were treated separately for the initial and advanced elementary administrative credentials. Also considered were titles and levels of elementary principals' certificates, degree requirements, teaching experience and teaching certificate prerequisites, principalship experience requirements for advanced credentials, validity and certificate renewal.

The data were obtained from a study of certification regulations requested from each state department of education. The fifty states and the Commonwealth of Puerto Rico were included in the survey. From a survey of the professional literature, a list of criteria were synthesized which represented a consensus relative to certification standards for the elementary principal. The findings were compared to the list of criteria and conclusions were drawn.

The data revealed several important facts concerning practices and minimum requirements for the certification of the elementary principal. Forty-seven states (for purposes of the study Puerto Rico was considered a state) issued one or more administrative credentials for the elementary principal; forty-six issued the initial credential; thirty issued the advanced credential; seven issued three levels of elementary administrative credentials; and several states issued limited principalship certificates of various types.

Undergraduate preparation included a minimum average of 49.4 semester hours of general education (average based on 30 states having semester hour requirements); the areas receiving the most emphasis were social science, science, and English. The undergraduate professional preparation included a minimum average of 24 semester hours (average based on 39 states); areas receiving the greatest emphasis were curriculum, educational psychology and foundations.

An average of 11.6 semester hours (38 states) of graduate professional education was required for the initial credential; twenty-nine states required an average of 24 semester hours of graduate professional education for the advanced certificate; the areas receiving greatest emphasis were general administration, elementary administration, curriculum, educational psychology, supervision and foundations.

A majority of the states specified the bachelor's degree for the initial credential and the master's degree for the advanced credential. Additional prerequisites for administrative credentials were possession of a teaching credential and an average of three years of teaching experience. Duration of validity was one to five years for the initial and life for the advanced.

Comparison with criteria showed minimum requirements for general and professional education deficient. The most outstanding deficiency was in graduate professional preparation. If prepared according to minimum standards, the average elementary principal in the United States has obtained less than 18 semester hours of work in graduate professional education.

Microfilm \$3.60; Xerox \$12.60. 277 pages.

AN ANALYSIS OF CERTAIN AREAS OF THE ADMINISTRATION OF EXTRA-CURRICULAR PROGRAMS IN SELECTED SIX-YEAR HIGH SCHOOLS IN INDIANA

(L. C. Card No. Mic 60-6047)

John Graham Cronk, Ed.D.
Indiana University, 1960

Chairman: I. Owen Foster

The Problem

The problem of this study was to analyze and to evaluate the administration of the junior high school homeroom, junior high school student council, junior high school assembly, and junior high school clubs in selected six-year high schools in Indiana. The three purposes of this study were: (1) to determine the status of these extra-curricular activities for junior high school pupils in six-year high schools, (2) to ascertain to what extent these activities in the junior high school grades of six-year high schools met the criteria as established in this study, and (3) to identify the problems encountered by the principals in administering these activities.

Procedure

The technique used for the collection of the data was the interview. Sixty Indiana six-year high schools were selected at random and each of the principals interviewed. These 60 schools were divided into six enrollment classifications. The data were evaluated by the criteria established in the study.

Findings

An analysis of the data indicated that (1) the junior high school homeroom was found in 40 per cent of the schools, (2) the junior high school student council was found in 13 per cent of the schools, (3) the junior high school assembly was found in 21 per cent of the schools, and (4) junior high school clubs were found in 29 per cent of the schools.

Conclusions

The following conclusions have been made from the data in this study:

1. The criteria selected were valid for the purpose of evaluating junior high school homerooms, student councils, assembly programs, and clubs.

2. Practicing junior high school principals were not as consistent in their evaluation of the criteria as were the authorities.

3. Junior high school pupils were provided with a greater opportunity to participate in junior high school homerooms, student councils, assemblies, and clubs in six-year high schools of over 600 pupils.

4. The selection of capable homeroom sponsors was a difficult administrative problem.

5. Little emphasis was given to guidance in the junior high school homerooms of six-year high schools.

6. One of the most difficult administrative problems in six-year high schools was scheduling junior high school homerooms, student councils, assembly programs, and clubs.

7. Finding a satisfactory method of financing junior high school student councils, assembly programs, and clubs was an administrative problem for principals of six-year high schools.

8. Since the most prevalent type of student government in six-year high schools was a junior-senior high school student council, little emphasis was placed on junior high school student councils and their activities.

9. Since assembly programs were characteristically planned for pupils of all grades in the six-year high schools, there was little attention given to the special needs of junior high school pupils in assembly programs.

10. There was very little opportunity for junior high school pupils to explore their interests through participation in the club program.

11. Junior high school extra-curricular activities are not likely to improve to a great extent until both training and administrative officials recognize the need for the training of sponsors of activities.

12. The evidence does not indicate that school administrators and sponsors adequately understand the purposes of the activities that are being held or that they are prepared to sponsor and control such activities.

13. Evaluation of junior high school homerooms, student councils, assemblies, and clubs were inadequate because of a lack of stated objectives and formal evaluation techniques. Microfilm \$4.40; Xerox \$15.55. 343 pages.

AN EMPIRICAL EVALUATION OF FIVE TESTS FOR THE SELECTION OF ELEMENTARY SCHOOL PRINCIPALS

(L. C. Card No. Mic 60-6703)

Francis John Ebert, Ed.D.
Stanford University, 1960

1. Statement of the Problem:

The Stanford Project for Leadership Development has assembled a test battery with the hope that it might prove to be valid and reliable in the selection and identification of potentially successful school leaders. The Study herein described is one research project designed to examine statistically the validity of a portion of this test battery. The tests studied are: (1) Miller Analogies Test, (2) F-Scale, (3) Minnesota Teacher Attitude Inventory,

- (4) Allport-Vernon-Lindzey Study of Values, and
(5) Edwards Personal Preference Schedule.

The following hypotheses were tested:

- Significant relationships will be found to exist between certain variables of the test battery and the success criterion.
- The high success administrators will obtain significantly different scores on certain of the test battery variables from the low success administrators.

2. Procedure:

This study was conducted in Oakland, California where 28 elementary school principals volunteered to participate. This district was selected in order to sample leadership behavior in a large urban school district. Companion studies sampled neighboring communities.

The criterion measurement instrument employed was the Purdue Rating Scale for Administrators and Executives. Each of the 28 principals was rated by three of his superordinates. The mean score of all three ratings became the success criterion score. In addition the Purdue Rating Scale was applied to a random sampling of those principals who did not participate. No significant difference on the success criterion was found to exist between those principals who participated in the study and those who did not.

Each of the participating principals took the five tests listed above. Test scores were correlated with the Purdue Scale scores, using Pearson product-moment coefficients of correlation.

In addition each group of principals was divided into High Success and Low Success groups. This division was made at the median of the Purdue Scale score. The mean was obtained for each test battery variable, and the means for the High Success and Low Success groups were tested for significant differences.

3. Results:

The significant (.05 level) Pearson r 's obtained were as follows: The Aesthetic Scale (.45) and the Economic Scale (-.43) of the Study of Values and the Order scale (.42) of the Personal Preference Schedule.

Upon examination of the differences between the mean of the High Success and Low Success groups, the High Success principals scored significantly higher on the Theoretical and Aesthetic scales of the Study of Values and the Succorance scale of the Personal Preference Schedule. This same group obtained lower mean scores on the Minnesota Teacher Attitude Inventory, Economic and Political scales of the Study of Values, and the Intra-ception scale of the Personal Preference Schedule.

4. Conclusions:

It can be concluded that the scales listed above are useful for the selection of elementary school principals. The entire battery appears to have utility as a screening device for the elimination of undesirable candidates as the ends of the continuum of each scale indicate lack of success.

This and companion studies indicate that successful administration varies from each situation depending upon the frame of reference of the rater. This means that different kinds of people, labeled successful, will be found from one district to another. Consequently the predictive value of these significant scales is unknown for other situations. However, all companion studies undertaken for the Stanford Project for Leadership Development indicate compatible results.

Microfilm \$2.75; Xerox \$5.80. 116 pages.

**CURRENT PRACTICES IN THE
ADMINISTRATION OF FIRE-INSURANCE
PROGRAMS IN MISSOURI PUBLIC SCHOOLS**

(L. C. Card No. Mic 60-6803)

Bobby Dean Elsea, Ed.D.
University of Missouri, 1960

Supervisor: Frank Heagerty

PURPOSE: The purpose of this study was to ascertain the practices followed in administering fire-insurance programs in six-director public high schools in Missouri and compare these practices with practices considered desirable or acceptable by writers in the field.

METHOD OF RESEARCH: The method of investigation was the survey, involving the use of an information form to collect data from school administrators. Usable returns were received from 370 school administrators, representing 69.4 per cent of the 533 school districts.

CONCLUSIONS:

1. School districts, in administering their fire-insurance programs, failed to make maximum use of the School Building Services provided by the State Department of Education.
2. It is apparent from the data in this study that as districts increased in size, they tended to follow more closely the recommendations expressed by the writers.
3. Boards of education tended to assign or permit insurance agents to perform tasks that should have been designated to some member of the administrative staff of the school district.
4. The procedure used by boards of education to establish a reliable method for appraising school property appeared weak when compared with recommendations of the writers.
5. No standard practice was evidenced by boards of education in distributing the insurance business among the local insurance agents.
6. By following recommended practices in insurance economies, Missouri school officials could effect savings in their insurance program.

RECOMMENDATIONS:

1. The State Department of Education should include a category concerning property loss and pre-

miums paid on fire-insurance in the annual Secretary's Report.

2. Boards of education should assign the administrative responsibility for the school insurance program to a specific member of the administrative staff.

3. Boards of education should require an adequate record of the insurance program to be maintained, using the form supplied by the State Department of Education. All policies and records should be stored in a fire-resistive vault located in a separate building or away from the school grounds.

4. Boards of education should establish insurable values through the use of a competent appraiser. The practice of holding an annual inventory should be followed in determining insurable values.

5. Boards of education should select the insurance carrier, rather than leaving this task to an insurance agent or agency.

6. Boards of education should distribute the insurance business to agents and brokers on the basis of some objective criteria established as requirements that must be met before agents or brokers can become eligible to participate in the school district's insurance business.

7. Boards of education should secure all possible insurance economies by:

- a. using the coinsurance clause or rider whenever possible or feasible.
- b. using the three or five year term policy.
- c. not insuring non-burnable items such as footings, foundations, architect's fees, and underground piping.
- d. classifying fixed items such as window shades, lockers, plumbing and lighting fixtures as part of the building rather than contents.
- e. having expiration dates for insurance policies fixed so that all policies expiring within a calendar year will expire at approximately the same date.
- f. securing the rating sheet used by the Missouri Inspection Bureau in making the rate. All penalties should be noted and after corrections are made, the school officials should request a re-inspection.
- g. inspecting school buildings at monthly intervals and removing fire hazards whenever encountered.
- h. using the blanket policy form in districts having a large number of buildings.
- i. submitting all plans and specifications for new buildings to the Missouri Inspection Bureau for suggestions and recommendations.

Microfilm \$3.05; Xerox \$10.60. 235 pages.

**VALIDATION OF THE CLAIMED
ADVANTAGES WHEN SCHOOL BUILDINGS
ARE CONSTRUCTED AND FINANCED BY
THE STATE PUBLIC SCHOOL BUILDING
AUTHORITY METHOD IN PENNSYLVANIA**

(L. C. Card No. Mic 61-34)

Beaver Stanley Faust, Ed.D.
The Pennsylvania State University, 1960

This study is an attempt to review and report significant facts about the Pennsylvania State Public School Building Authority, to determine what advantages are claimed for this method over the municipal authority method of financing school buildings in Pennsylvania, and to validate these claimed advantages.

It was necessary to determine what the claimed advantages were, and to validate them through factual data and through replies to a questionnaire sent to all county and district superintendents in Pennsylvania in whose areas both authority methods had been used.

Factual data were collected on 63 pairs of matched projects and included bid costs plus architect's fee, area in square feet, interest rate, years to amortize bond issue, financing charges, and cost of construction inspection service. The questionnaire replies represented the experience of 47 county and 10 district superintendents regarding 23 claimed advantages of the State Public School Building Authority, and 11 questions pertinent to authority financing in their jurisdictional areas.

The following advantages claimed for the State Public School Building Authority method were validated:

1. The cost of financing a project is less.
2. Maximum interest rate and bond discount are known before projects are bid.
3. Dependable construction inspection costs less, particularly on smaller projects.
4. The necessity for requesting bids for the sale of bond issues is desirable.
5. Method of inspection gives greater assurance that
 - a. Plans and specifications are being followed.
 - b. All items and materials of construction are checked by trained personnel.
 - c. Rejected materials are removed from project site.
 - d. Discrepancies in plans and specifications are more likely to be found before projects are bid.
 - e. Proper decisions regarding construction will be made and carried out.
6. Method of inspection relieves board members and school administrator of much project supervision.
7. The school district profits from the Authority's previous experience.
8. Projects are less exposed to undesirable local pressure groups.
9. Greater consideration is given by suppliers and contractors in making adjustments in materials and workmanship.

10. There is greater assurance that part of a site may be reconveyed to the school district if an addition is to be placed by a different method of finance.
11. Preparation of specifications, requesting and accepting of bids for movable furniture and equipment as well as the inspection service on the same, is desirable.

The respondents' replies indicated other facts about authority financing. The State Authority does not actively solicit business. Municipal authorities are often promoted by potential fiscal agents who offer services without charge provided their organizations are permitted to purchase the bond issues without active competition. Many boards of school directors are not in a position to intelligently appraise an offer made for a bond issue.

Microfilm \$3.00; Xerox \$10.60. 231 pages.

**A COMPARATIVE STUDY OF COUNTY
SCHOOL SUPERINTENDENT ROLES
UNDER ELECTIVE AND APPOINTIVE
SYSTEMS OF SELECTION**

(L. C. Card No. Mic 61-539)

Harrison Calvin Godfrey, Ed.D.
Auburn University, 1961

Supervisor: John T. Lovell

This study was designed to investigate the practices of county school superintendents under elective and under appointive systems of selection as these practices are described by several groups of professional educators for the purpose of presenting information with regard to differences and similarities of perceived practices of superintendents representing the two methods of selection. Specifically, this investigation sought, through a factor analysis of superintendent role descriptions, to determine: (1) the factorial composition of the descriptions of elected and appointed superintendent functions including (a) the number of factors necessary to describe the matrix of intercorrelations of descriptions and (b) the nature of the factors in terms of the descriptive statements entering into their composition; (2) the differences present in descriptions of behavior attributed to elected and to appointed superintendents as to the number of factors utilized and as to their respective loadings.

The population of experts utilized to describe the practices of county school superintendents included the following groups in the states of Alabama, Georgia, Kentucky, and West Virginia: (1) members of state departments of education (2) staff members of university departments of educational administration, and (3) selected county school superintendents. Descriptions obtained from these agencies in the states of Alabama and Georgia concerned behavior of superintendents who were elected to office by popular vote, while descriptions made by similar agencies in Kentucky and West Virginia depicted practices of superintendents who were appointed to office by lay boards of education.

The extent to which the problem concerning the county school superintendency could be investigated and comparison

of the two types could be effected was limited by weaknesses in the statistical procedures used and by inadequacies of the measuring instrument. It was noted that the instrument employed for the collection of data was fairly new and had not been used extensively for research purposes. This instrument was an eighty-four item Q-sort. Its development and a rationale for its use in the present investigation are discussed in some detail in the dissertation.

The Q-sort instrument was used to obtain descriptions of superintendent practices in both the current functioning role and in the perceived ideal role. The descriptions thus obtained were then analyzed statistically mainly through correlation and factor analysis using an IBM 650 electronic digital computer. The complete Thurstone Centroid Method of factor analysis was used in conjunction with the Quartimax Method of orthogonal rotation of the reference axes.

The findings and conclusions formulated therefrom deal mostly with seven factors which were extracted from the correlation matrix and described in terms of the Q-sort items associated with them. On the basis of these findings and within the limits of the experimental design, several conclusions appear to be warranted regarding the perceived practices of elected and appointed superintendent practices together with hypotheses regarding the roles idealized for the superintendency, whether elective or appointive. It was thus concluded that (1) in general, the county school superintendency, whether filled by popular vote or by lay board appointment, is viewed with much disappointment by both state department of education members and university educational administration staffs, and this view is often shared by the county superintendents. (2) The functions of both elected and appointed county school superintendents are seen to be influenced by an inclination to serve the group to whom they are directly responsible. (3) There is little agreement between county school superintendents, state department of education members, and university educational administration professors as to what functions the county superintendency should embrace. Different roles are idealized by the different groups, and where similar views are expressed, considerable difference in emphasis is evident.

Microfilm \$4.05; Xerox \$14.20. 313 pages.

A SUGGESTED REVISION OF THE INDIANA SCHOOL SUPPORT FORMULA TO ENCOURAGE THE DEVELOPMENT OF ADEQUATE LOCAL SCHOOL DISTRICTS

(L. C. Card No. Mic 60-6052)

Richard Paul Gousha, Ed.D.
Indiana University, 1960

Chairman: W. Monfort Barr

Problem

The problem with which this study is concerned is a revision of the distribution formula for state financial support of public schools in the state of Indiana with the purpose of encouraging the development of adequate local

school districts by providing a system of financial incentives and rewards or by providing such penalties as withdrawing or reducing state financial support.

Procedures

Procedures followed in the study were three-fold:

- (1) related professional literature was reviewed to determine specific features of state school finance programs which influence local school district reorganization,
- (2) a suggested revision of the Indiana state school support formula was determined which utilized incentives and penalties to encourage the development of adequate local school districts, and
- (3) the suggested revision of the state school support formula was applied Indiana school districts, and the initial and ultimate costs to the state were determined.

The primary sources of 1958-1959 data for the 940 Indiana local school districts used in the study were the official reports of public school officials to the Indiana State Superintendent of Public Instruction and research data compiled by the Division of Research of the Indiana State Teachers Association.

In this study 237 Indiana school districts, including 147 adequate and 90 partial county units, were used to determine the suggested revision of the state distribution formula. Adequate local school districts for purposes of the study were districts which met or surpassed the minimum standard adopted by the State Commission on School Reorganization requiring that a district shall have an average daily attendance of not less than 1,000 resident pupils in grades 1 through 12. The partial county units used in the study consisted of an arbitrary grouping of local school districts in each county considered inadequate according to the above minimum attendance standard.

Principal Findings

Principal findings were: (1) only 147 Indiana school districts in 1958-1959 met the minimum school enrollment standard established by the state commission for the reorganization of school corporations. (2) State subsidies to 348 school districts in support of more than 37,000 pupils transferred to schools out of the district amounted to more than \$3.5 million. (3) A defensible state support program for capital outlay and debt service as an incentive for reorganization was found to be \$600 per teacher unit minus the yield of a local chargeable 10 cent tax rate on each \$100 of local adjusted assessed valuation. (4) The ultimate cost of the program, using 1958-1959 data, would approach \$16 million; of this amount \$9 million would be supplied from state sources as an incentive for reorganization. The program would require \$7 million from local sources.

Conclusions

- (1) Reorganization of local school districts is urgently needed in Indiana, since 35 per cent of the public school pupils in the state reside in inadequate school districts.
- (2) Funds distributed to closed school districts and for transfer pupils in Indiana might better have been used as a financial incentive for adequate school district organization.
- (3) An equalized incentive program for reorganization would provide substantial property tax relief.

(4) State support as an incentive for employment of administrators has proved successful in Indiana. A comparable program for capital outlay and debt service would spur reorganization. (5) State financial incentive for adequate organization of Indiana schools might well be granted for capital outlay and debt service, since these two major expenditures are not now included in the Indiana state support program.

Microfilm \$2.90; Xerox \$10.15. 221 pages.

**FACTORS INVOLVED IN THE
DECISION-MAKING PROCESS ON LOCAL
ISSUES IN FIVE SELECTED COMMUNITIES
OF KENTUCKY WITH IMPLICATIONS FOR
EDUCATIONAL ADMINISTRATION**

(L. C. Card No. Mic 61-297)

James Bernard Graham, Ph.D.
University of Kentucky, 1956

Director: Dr. C. Howard Eckel

Purpose of Study

The purpose of the study was to identify contributing factors and to describe the process by which communities arrive at decisions on local issues within selected communities of Kentucky. It was assumed that a study of decision-making within communities has implications for educational administration. The study, conducted in conjunction with four other studies which focused upon research in communities, was made under the direction of the Kellogg Project at the University of Kentucky.

Delimitation of Study

As a basis for selecting the five counties for research, an isolation scale was prepared by the Kellogg Committee. The isolation scale ranked the 120 counties of Kentucky on a rural-urban continuum. Five counties, representing varying degrees of urbanization or different points on the continuum, were selected for study.

After selection of the five counties for research, one issue was selected for study in each of the counties. Four of the issues were concerned with problems faced by educational administrators and the fifth issue dealt with the construction of a hospital for the community.

Collection of Data

The questionnaire-interview technique was used in collecting the data. A questionnaire was developed which was closely related to the subproblems of the study. The questionnaire was tested and revised after interviewing leaders in counties other than the five counties selected for research.

To solve the general problem with which the study dealt, leaders within the five communities were identified and interviewed. Other persons more involved with the issue were interviewed. Additional data were secured from school board minutes, court records, and parent

teacher association minutes. The data were collected during the spring of 1954.

Basic Assumptions

A prime assumption upon which the study was based is that a knowledge of community life, the interrelations of various sub-systems of the community, and skill in the techniques of understanding communities add to the effectiveness and success of educational administrators. A further assumption was that problems and issues are inevitable in our society and the ways in which they are resolved are of vital importance to educational administration.

Basic Hypotheses

Hypotheses of the study were that as communities differ in degree of isolation, they also differ in patterns of decision-making on issues, and that factors which contribute to a final decision on issues within communities could be identified by study.

Conclusions and Implications

There were indications that despite the many persons who participated in the process of decision-making on community issues, only a few key persons were ultimately responsible for the final decision.

The study showed that issues originate in communities because of a need to be fulfilled or a problem to be resolved.

Two factors of significance in contributing to a final decision on the issues in more urban communities were rural versus urban interests and the element of tradition.

A factor of importance in contributing to the final decision on issues in less urban communities was the element of resistance to change basic beliefs and established practices.

The educational administrator should be able to identify and be receptive to the needs of communities. He should be able to interpret the problems and issues which affect the public school to all the community in light of the school program and in the future of American democracy.

The educational administrator should develop and demonstrate skill in a broad range of democratic processes. Only a well conceived, continuous and consistent program of communication with the citizens can contribute to a mutual understanding between the school and the community.

In the preparation program, experiences in working with groups and organizations should be provided the educational administrator to enable him to develop a knowledge of group dynamics.

The author hoped that the study might influence or contribute to a theory of school administration which could cope adequately with the needs and issues of modern society. It was further hoped that the findings might be of such a nature that they can be useful to practicing administrators who are confronted with providing creative community leadership in changing communities of America.

Microfilm \$2.75; Xerox \$7.40. 156 pages.

PLANS OF METHODIST COLLEGE
PRESIDENTS DURING A DECADE
OF EXPANSION IN HIGHER EDUCATION

(L. C. Card No. Mic 60-5863)

John Birney Gross, Ph.D.
George Peabody College for Teachers, 1960

Major Professor: J. E. Windrow

This study presented the proposed plans for 1970 of the colleges affiliated with the Methodist Church. These proposals were obtained from a questionnaire submitted to the seventy-four Methodist colleges; approximately 70 per cent were returned and included in the study. The results were divided into three problem areas of higher education: students, faculty, and finance.

Students. The enrollment in the Methodist colleges is predicted to increase 47 per cent from 1958 to 1970. However, it would not be as significant an increase as the increase in the total national enrollment. As in 1958, the 1970 enrollment in the Methodist colleges would consist of 75 per cent resident students and 25 per cent commuting students.

The admission policies for 1970 are not expected to be much different from those of 1958. It is anticipated that there would be a higher degree of selectivity of admission in 1970 than in 1958.

Faculty. It is the opinion of the colleges that there would be about 31 per cent more full-time faculty in 1970 than in 1958. The percentage increase in faculty is not expected to be as great as the percentage increase in student enrollment. The colleges do not plan to expand the use of part-time faculty by 1970.

Other information concerning the faculty shows that a larger number of faculty members with Ph.D. degrees is expected by 1970. The median student-faculty ratio increased three from 1953 to 1958 and is expected to increase one--15.1 to 16.1--by 1970. While the total number of hours a typical faculty member would teach is expected to decrease, the approximate average class size is expected to increase.

The Methodist colleges plan to continue to seek new faculty personnel in 1970 from the same sources used in 1958. An interest in the continued use of retired faculty members was expressed. However, such a practice would probably be limited.

The colleges are unanimous that there would be a faculty tenure policy by 1970. A policy relative to a faculty salary scale for 1970 is not expected to be as firmly stated as the tenure policy.

The faculty fringe benefits in 1958 would probably be the same for 1970. The colleges expect to pay a larger percentage of the costs of the fringe benefits by 1970, but not the full cost.

Finance. The colleges showed a decided increase in income, expenditures, and total value of the physical plant and endowment from 1953 to 1957. A sharp increase in the dollar value of the endowment and physical plant is predicted from 1958 to 1970.

The total annual student cost to attend the Methodist colleges was expected to be more in 1970 than in 1958. Only one college estimates a cost in 1970 of less than \$1,000, while six colleges would probably charge over \$2,000; the median cost is expected to be \$1,500.

Contributions from various sources such as the alumni and churches are expected to continue to increase through 1970. However, no increase in funds from the federal government is expected.

A space utilization study proved to be significant in prior expansion of the physical plant and would continue to be considered highly important in the future. It showed ways and means by which the physical plant could be used more economically.

This study reveals the plans of the Methodist colleges for 1970, and shows that these colleges approach the future with definitely formulated proposals.

Microfilm \$3.25; Xerox \$11.25. 249 pages.

THE JOINT PHILIPPINE-AMERICAN
PROJECT FOR EXPANDING AND
IMPROVING VOCATIONAL INDUSTRIAL
EDUCATION IN THE PHILIPPINES, 1951-1956.

(L. C. Card No. Mic 60-6709)

Sidney Cooke High, Jr., Ed.D.
Stanford University, 1960

1. Statement of the Problem

For more than a decade, as part of the over-all American assistance to the underdeveloped areas of the world, the United States Government has been engaged in projects designed to help underdeveloped countries expand and strengthen their systems of industrial education. Industrial education has come to be widely recognized as an essential component of national plans for industrialization and economic development. As efforts are intensified to help in the economic growth of the underdeveloped areas of the world, assistance projects in industrial education will continue to form an important part of these efforts. In order to make future assistance in industrial education more effective, there is a need for reviewing, analyzing, and evaluating some of the experience which has been gained to date.

The specific project chosen for analysis in this dissertation was the joint Philippine-American project for expanding and improving vocational industrial education in the Philippines, an undertaking sponsored by the U. S. International Cooperation Administration and the Philippine National Economic Council. The dissertation is limited to the first five years of the project, beginning July 1, 1951, and ending June 30, 1956.

2. Procedure

First, background information was compiled, both on the development of American foreign assistance since World War II and on the general Philippine environment. This background information serves to portray the surrounding conditions and events which influenced the planning and implementation of the project.

Next, the project itself was described in narrative fashion. The narrative begins with a statement of the history and status of vocational industrial education in the Philippines as of 1951, at the beginning of the project. The development of the five-year plan for the project is

described and the content of the plan is summarized. The launching of the project is related and a detailed description is provided of the implementation of the project during its first five years of operation.

Following the narrative account of the project operations, a detailed analysis was made of the several strands of the project, such as the importation of equipment, the construction of buildings, the provision of technical assistance, the conducting of in-service training programs for employed teachers, and the strengthening of the pre-service education of new teachers.

3. Results

On the basis of the analysis of the project operations, the accomplishments of the project during the first five years were reviewed. It was determined that, considering the progress made in all aspects of vocational industrial education in the Philippines between 1951 and 1956, the objectives of the first five years of the assistance project were substantially accomplished and a strong momentum of progress was developed. Following the review of the project accomplishments, an examination was made of the strengths and weaknesses in the planning and execution of the project during the first five years.

4. Conclusions

From the experience gained during the first five years of this assistance project in the Philippines, a series of guidelines was formulated for similar projects which might be undertaken in underdeveloped countries in the future. The guidelines are divided into two categories: administrative and technical.

The administrative category, which includes 37 items, consists of procedural guidelines for the over-all planning and administration of a project. The technical category, which includes 6 headings, consists of guidelines for the substantive content of a vocational industrial education project in an underdeveloped country.

The dissertation closes with five specific suggestions for further study.

Microfilm \$11.56; Xerox \$41.60. 924 pages.

THE CRITICAL REQUIREMENTS FOR SERVICES OF STATE DEPARTMENTS OF EDUCATION AS REPORTED BY LOCAL SCHOOL ADMINISTRATORS

(L. C. Card No. Mic 61-300)

George William Hopkins, Ed.D.
University of Kentucky, 1956

Director: Dr. A. D. Albright

The problem central to this study was to determine the critical requirements for services of state departments of education. The problem grew out of demands on the part of local school systems for additional services from state departments of education, which resulted in the rapid

enlargement of the technical and professional staffs of departments. This enlargement of department staffs took place so rapidly that many departments did not have time to take a critical look at themselves. This study attempted to take such a critical look.

In this study it was assumed that the aim of state department personnel is to render services to local school systems and that local supervisors and superintendents constitute an authoritative source on the effectiveness or ineffectiveness of the activities of departments. Since supervisors and superintendents were considered to be good sources of data, this study was planned to make use of a research technique known as the critical incident technique. The basic aspect of this technique was to have the respondents, that is supervisors and superintendents, furnish incidents which would relate the activities of state departments of education in rendering a service to them which they considered outstandingly effective or ineffective.

The incidents which were submitted by supervisors and superintendents of the southern states fell into the following categories:

- I. Assisting schools in their in-service programs
- II. Providing services in the areas of finance, organization, and public relations
- III. Providing services related to the instructional program
- IV. Coordinating other educational forces and agencies to improve education
- V. Assisting school systems in their evaluation and accreditation activities.

After the categories of services were obtained, the incidents were re-analyzed to determine the specific services which had been performed in each category, along with behaviors reported in each effective and ineffective service. This analysis revealed the following:

Critical Activities Associated with Effective and Ineffective Service

Effective	Ineffective
1. Identified clearly the problem	1. Did not identify the problem
2. Pre-planned activity with local people	2. Arbitrarily decided on plan and procedure
3. Acted in accordance with role expectancy of receiving agency	3. Did not act in accordance with role expectancy of receiving agency
4. Engaged in research on problem	4. Engaged in inadequate research
5. Involved those affected by result in solution of problem	5. Acted in a dictatorial manner, talked to, but did not involve those affected by result in solution of problem
6. Made available needed resources	6. Did not make available needed resources

**Critical Activities Associated with
Effective and Ineffective Service (Cont.)**

<u>Effective</u>	<u>Ineffective</u>
7. Provided for participation, discussion, and leadership activities in the group	7. Provided for limited participation, discussion, and leadership activities in the group
8. Consolidated thinking into a cooperative solution to problem	8. Formulated solution to problem in terms of regulations
9. Provided for evaluation and follow-up activities	9. Did not provide for evaluation and follow-up activities
10. Provided technical assistance	10. Provided inadequate technical assistance
11. Exhibited good interpersonal relations	11. Exhibited poor interpersonal relations

This analysis also indicated that there were certain personal characteristics exhibited by the person performing the service which had a bearing on the effectiveness or ineffectiveness of the service.

The following was the result of this analysis:

<u>Ascribed reasons for effectiveness</u>	<u>Percent of total reasons given in this area</u>	<u>Ascribed reasons for ineffectiveness</u>	<u>Percent of total reasons given in this area</u>
1. Conveyed a feeling of wanting to help	12.78	1. Showed a lack of interest in the problem of the receiving agency	15.85
2. Conveyed a feeling of warmth and empathy	21.05	2. Was cold and unsympathetic	34.15
3. Conveyed a feeling of trust of others	17.29	3. Took advantage of others	10.98
4. Conveyed a feeling of respect for other attitudes and viewpoints	21.05	4. Exhibited a "know-it-all" attitude	7.32
5. Conveyed the feeling of being an accepting person	17.29	5. Exhibited a critical attitude	14.63
6. Conveyed the feeling of having a democratic attitude	10.53	6. Contended openly with others, showing an antagonistic attitude	17.07

Certain implications evolved from the analyses of practices. For personnel of state departments of education to perform effective services, a working climate, as free

from threat, is necessary. Staff members need a continuous opportunity to conceptualize the role indicated by the analysis of effective behavior.

A permissive climate can be more readily effected when the personnel of a state department can redesign the internal structure and organization of the department in terms of the problems to be solved through the schools of the state. A task-oriented problem-solving approach seems to provide a basis for developing a mobility of internal departmental arrangements for services.

The development of mutual goals in a department staff which require change in operational procedures requires adequate communication. Communication demands a "free exchange" climate and a flexible structure.

Microfilm \$3.15; Xerox \$11.05. 242 pages.

**THE EDUCATION OF THE CHILDREN
OF AGRICULTURAL MIGRANTS IN THE
PUBLIC SCHOOLS OF NEW YORK STATE**

(L. C. Card No. Mic 61-511)

Merrill Frye Hurd, Ed.D.
Syracuse University, 1960

This study concerns the educational services available to the 2000 to 3000 Negro children of migrant agricultural workers who come annually to New York State for the harvest season. It combines a normative-survey study covering responses of public school administrators and teachers throughout New York State, with detailed case studies by individual interviews with migrant children, parents, and interested citizens in six selected communities.

Intensively studied are such problems as:

1. What are the attitudes of resident children, school and community groups toward migrants?
2. What curricular and instructional provisions and adaptations should public schools make for migrant children?
3. What pupil and grade placement procedures most effectively meet the needs of migrant children?
4. Are current policies adequately meeting the school-related health and welfare problems of migrant children?
5. Are the efforts of public schools and other agencies serving migrants being most satisfactorily coordinated?
6. What financial arrangements and adjustments might encourage public schools to extend and improve their services for migrant children?
7. What state and federal services for children of migrants could and should be provided in addition to those now available?

The second chapter is a 120-page summary of published and unpublished literature relating to the above topics to January, 1957.

The major study results are based on replies to questionnaires sent to principals and teachers in all New York State schools known to enroll migrant children. Six schools were chosen for intensive study. Three of these were selected by experts as having state-wide prominence in meeting the educational needs of migrant children, and three were picked at random for comparison.

Among major findings of the study were:

1. While 38 per cent of migrant children were academically average, only one per cent were above average, and the remainder were one to three years retarded.
2. Adequate records of birth, health and grade placement are seldom available for migrant children.
3. School officials indicated that neither discipline nor racial antagonism were serious problems.
4. Migrant children's regularity of attendance almost equalled that of non-migrants.
5. Migrant parents seemed generally satisfied with New York's schools.
6. Most migrant parents thought they were able to provide their children with adequate clothing.
7. Free lunch requests by migrant children were below the average for non-migrants.
8. Migrant children participate in few outside activities.
9. Most teachers thought migrants need extensive drill and remedial work.
10. State operated migrant summer schools were advocated.
11. Few taxpayers opposed educating migrant children, but most administrators believe state financial aid does not adequately cover migrant cost.
12. Differences between select and comparison schools appeared to be not so much in treatment of migrant children as in numbers involved and in public relations.

Among the significant implications drawn from this study are these:

1. Expect well over half of the migrant children to be academically below average for their age - with many greatly retarded.
2. Integrate migrant children into regular classes.
3. More migrant participation in classroom and extra curricular activities should be encouraged.
4. Balanced cafeteria meals and instruction in home-making are especially valuable to migrants.
5. Adequate school census and compulsory attendance procedures are essential.
6. If the migrant child arrives with no records, considerations in placement should include age, size, maturity, interview impression, teacher load, and a sympathetic teacher.
7. State and federal authorities should agree upon a universally acceptable transfer record.
8. Effective community migrant services require a coordinating committee.
9. Schools regularly serving migrants need special financial aid to cover migrant related building and construction costs.
10. A full time State Education Department Migrant Supervisor is advocated.

The study includes a bibliography of 183 annotated references. Microfilm \$4.95; Xerox \$17.55. 387 pages.

AN EMPIRICAL EVALUATION OF FIVE TESTS FOR ADMINISTRATOR SELECTION IN A METROPOLITAN SCHOOL DISTRICT

(L. C. Card No. Mic 60-6710)

Kenneth Raymond James, Ed.D.
Stanford University, 1960

1. Statement of the Problem:

This study was undertaken to develop validity data on five psychological tests comprising, in part, the Kellogg-Stanford Test Battery for Administrative Candidates. These were: The Miller Analogies Test, the Minnesota Teacher Attitude Inventory, the Adorno F Scale, the Allport-Vernon-Lindzey Study of Values, and the Edwards Personal Preference Schedule.

It was hypothesized that significant relationships would be found to exist between the battery variables and the Purdue Rating Scale for Administrators and Executives, used as the administrative success criterion. It was further hypothesized that significant differences would be found to exist between the scores of administrators rated as more effective school leaders and those rated as less effective.

2. Procedure:

The study was conducted in the San Francisco Unified School District. The sample consisted of twenty-five elementary school principals who volunteered to negotiate the test battery in a six-hour testing period and to be rated on the criterion by three superordinates. The mean score of the three ratings became the success criterion score. In addition, the Purdue Scale was applied to a random sample of non-participating principals. No significant differences between the ratings of participants and non-participants was obtained, indicating that the volunteer sample included an acceptable range of high and low rated administrators.

Each of the participants took the five tests listed above. Test scores were correlated with the criterion scores using the Pearson product-moment technique. In addition, the sample was divided, at the frequency distribution median, into high and low success groups on the basis of criterion ratings. Each coefficient of correlation and the differences between the means were tested for significance.

3. Results:

A. The following significant correlations between test battery variables and the criterion were obtained, at the .05 level:

	<u>r</u>
Miller Analogies Test	-.43
Study of Values	
Theoretical	-.55 (.01 level)
Political	-.45
Edwards Personal Preference Schedule	
Autonomy	-.44

Affiliation	.46
Intracception	.41
Aggression	-.61 (.01 level)

B. The following significant differences between the means of the high and low success groups were obtained, at the .05 level:

	Significantly Higher High Group Low Group
Minnesota Teacher Attitude	
Inventory	x
Study of Values	
Economic	x
Edwards Personal Preference	
Schedule	
Exhibition	x
Autonomy	x (.01 level)
Intracception	x

4. Conclusions:

A. The test battery appears to have utility as a screening device to discriminate between extreme cases - those most likely to be failures and successes - and so reduce the risk in administrator selection procedures.

B. This, and other validation studies on the Kellogg-Stanford Test Battery, indicate that the situational factors and rater perception in a particular district at a selected moment determine who is more or less the effective administrator. The studies, however, have produced compatible findings.

Microfilm \$2.75; Xerox \$7.40. 158 pages.

A DEFENSIBLE FOUNDATION PROGRAM AND DISTRIBUTION FORMULA FOR INDIANA

(L. C. Card No. Mic 60-6058)

Herbert Merle Jones, Ed.D.
Indiana University, 1960

Chairman: W. Monfort Barr

Problem

The purposes of the study was to devise a defensible foundation program and a distribution formula to compute the amount of state support for each school district in Indiana.

Procedures

The problem was investigated by selecting a cross section sample of school districts ranked according to their taxpaying ability per unit. This sample was used to compare the distribution of state support computed for the

existing foundation program and a hypothetical foundation program. The existing foundation program was computed using the state support data from official reports filed in the Office of the State Superintendent of Public Instruction for the 1958-1959 school year, the most recent reports available. The formula for distributing state support was computed using the 1959-1960 foundation levels. However, a uniform value of the classroom unit was used in computing the foundation program funds of a district. Therefore, since the local chargeable tax rate was uniform, a district's computed state share was in inverse proportion to its taxpaying ability. The hypothetical foundation program was computed by using the same total state support, the same local chargeable tax rate, and the same method of measuring local ability as was used in the existing foundation program. A computation was made of the amounts of state support to local districts using each of the two programs. Differences in the amounts of state support computed by using both programs were tested to determine whether the differences were significant. After it was found that the distribution of state support using the existing foundation program did deviate significantly from the hypothetical, the study further involved the development of a defensible foundation program and a distribution formula. An analysis of current operating expenditures of a selected sample of school districts was made to determine the level of the foundation program. A single uniform tax rate was established at a level that would produce the revenue needed to support the proposed program in a school district having both a high taxpaying ability per unit and a large enrollment. After the level of the proposed program and the uniform chargeable tax rate were determined, the formula was applied to all school districts in the state to determine the local and state shares per unit.

Findings

(1) The existing foundation program does not distribute state support to Indiana school districts in inverse proportion to the district's taxpaying ability. (2) The difference between the correlation of the district's taxpaying ability and state support computed for both programs was significant at the one per cent level of confidence. (3) Current expenditures for public school education in Indiana schools of average wealth having 1,000 or more pupils in average daily attendance were \$8,990 per unit. (4) A uniform tax rate, to be applied to all school districts, was found to be \$1.25 on each \$100 of taxables. (5) Only three schools of adequate size would not participate in the proposed defensible foundation program.

Conclusions

(1) The foundation level of \$4,800 per classroom unit is unrealistic, and far lower than the actual expenditure in adequate districts.

(2) State school funds are not distributed in inverse proportion to the district's adjusted assessed valuation.

(3) A foundation level of \$8,990 per educational unit and a local chargeable tax rate of \$1.25 per \$100 of taxables could have been provided in 1958-1959 with an annual appropriation of \$161,091,422.

Microfilm \$3.55; Xerox \$12.40. 274 pages.

**A HISTORY AND EVALUATION OF THE
FIVE YEAR STUDY PROJECT OF THE TEXAS
ASSOCIATION OF SCHOOL ADMINISTRATORS**

(L. C. Card No. Mic 60-5519)

Charles Frederick Mathews, Ed.D.
Texas Technological College, 1960

Chairman: Morris S. Wallace

The problem of this study was to investigate the selection and utilization of the study projects included in the five-year program of the Texas Association of School Administrators. More specifically this study attempted (1) to assess the state-wide organization for curriculum and instructional improvement in the project; (2) to learn how each phase of instructional organization was selected for concentrated study from 1955 to 1960; (3) to study the role of superintendents in instructional improvement resulting from the program; (4) to determine ways and means of improving certain phases of instructional organization; (5) to evaluate the state-wide study projects.

The data for this study were obtained from (1) the files of the Texas Association of School Administrators and the Texas Education Agency, (2) personal interviews with superintendents in charge of the area and state projects in Texas, (3) a questionnaire involving four major headings: School Administrators' Reactions to the Study Project; Specific Examples of Improvement That Are Believed to Have Resulted from Participation in the Project; A Comparison of the Participating School's Instructional Program of 1955 and 1960; Professional Growth and Development of the Administrator as a Result of the Project.

The questionnaire was sent to 500 superintendents who were members of the Texas Association of School Administrators and who were involved in the project. A total of 309 questionnaires, or 62 per cent, were returned in usable form.

The study revealed the following conclusions:

1. Many superintendents indicated that stimulation of active interest in the school's instructional program was acquired through association and participation with other administrators to a degree that could not have been achieved from any other source.
2. The data support the conclusion that an in-service education program can strengthen the instructional program, particularly in connection with pupil differences, mathematics, science, and reading.
3. The data support the conclusion that a carefully planned study of instructional problems was essential and should not be separated from day-to-day duties of the administrator. Among the improvements resulting from the Project are the following: an organized plan for audio-visual education; a planned testing program; a written plan for teaching health, safety, and physical education; a written plan for guidance; a systematic plan for determining needs of pupils and community; a planned and organized science program; and an organized plan to provide for individual differences of pupils, including those of exceptional ability.
4. The In-Service Project of the Texas Association of School Administrators was reported by superintendents to have aided in resolving both general and specific problems in providing for individual differences as follows:

Developing organized guidance procedure to channel qualified pupils into science courses; providing for individual differences in reading; developing counseling services to assist students in selecting mathematics courses; and providing an organized plan to take care of individual differences in the total instructional program.

5. Administrators involved in this study reported that budget allocations for specific program areas have been significantly improved in connection with materials and supplied for the library, for audio-visual services, for laboratories, for mathematics courses, and for testing and guidance programs.

6. A further conclusion revealed by this study was the fruitful cooperative relationship existing between the Texas Education Agency, Texas Association of School Administrators, and Texas colleges and universities.

Microfilm \$2.75; Xerox \$12.40. 205 pages.

**A CRITICAL EVALUATION OF THE FOUR
TRACK CURRICULUM PROGRAM OF THE
DISTRICT OF COLUMBIA SENIOR HIGH SCHOOLS
WITH RECOMMENDATIONS FOR IMPROVEMENT**

(L. C. Card No. Mic 60-4928)

George Wilbur McCown, Ed.D.
University of Maryland, 1960

Supervisor: Clarence A. Newell

This study was undertaken to determine the relationships between the grouping practices of the four track curriculum program in the District of Columbia senior high schools and the levels of achievement of the students involved in the program. The four curriculum tracks are: honors, regular (college preparatory), general, and basic (remedial).

The difference between the four track curriculum program of the District of Columbia senior high schools and the curriculum programs of other senior high schools with more heterogeneous grouping is the special consideration given the honors track (gifted) students and the basic track (remedial) pupils. The academic program for the other two groups is very similar to that of other senior high schools.

The subjects of the study are the 275 honors track students and the 663 basic track pupils of the graduating class of 1959 in the ten senior high schools of the District of Columbia.

The achievement records of the 275 honors track students of the graduating class of 1959 are compared to similar records of an equal number of top scholastic graduates of the class of 1958 who completed their high school course under a more heterogeneous grouping program.

The results of the California Test of Mental Maturity and the Stanford Test in reading and arithmetic show the two groups to be nearly equal scholastically when they entered senior high school.

The students in these two groups were given the Iowa Test of Educational Development in English, social studies, natural science, and mathematics and the College Entrance Board, Scholastic Aptitude-Verbal and

Mathematics, examinations when they were in the senior class in high school. The results of these objective examinations show the honors curriculum track students of the graduating class of 1959 to be superior in achievement to the top scholastic students of the 1958 graduating class in all areas. The men and women of the 1959 graduating class led the comparison group in test results in the upper quartile, the median, and the lower quartile.

The educational program for the mentally retarded pupils in the basic curriculum track was also investigated. Tables in the study show the holding power of the senior high schools for this group, the growth in reading ability of these pupils, and information relative to the course of study used in this curriculum track.

The results of interviews with the principals, vice-principals, and counselors, and questionnaires, sent to the teachers and pupils in the program are also included in the study.

An interpretation of the data in this study seems to show that the four track curriculum program is accomplishing its aims of satisfying the educational needs of the students of the senior high schools of the District of Columbia with their different educational backgrounds and abilities.

In the final chapter on summaries, interpretations and recommendations, the writer expressed approval of the program and made some recommendations to strengthen it. The writer further recommends that other school systems with similar educational problems study the four track curriculum program.

Microfilm \$2.75; Xerox \$8.20. 177 pages.

A STUDY OF THE COLLEGE FRESHMEN ORIENTATION-WEEK PROGRAM

(L. C. Card No. Mic 60-4349)

Richard Bruce Mease, Ed.D.

The University of Nebraska Teachers College, 1960

Adviser: Dr. Leslie L. Chisholm, Ph.D.

The Problem

The purpose in this study is to survey and analyze college freshmen orientation-week programs with special reference to selected four-year church-related colleges in Missouri with the belief that the findings will throw light upon the establishment of desirable principles and procedures.

The Procedure

A thorough study of the opinions concerning college freshmen orientation-week programs was made at the three levels of operation, the expert, the administrator and the student by the interview and questionnaire methods of research. Those participating in the study included two hundred and one students and thirteen administrators from the nine Missouri colleges, and twenty-four experts selected from throughout the United States.

The Findings

The principal conclusions of this study were:

I. Conclusions applicable to the general process of orientation of college freshmen

1. The Orientation-Week Program is but one part of the total and complete orientation of college students.
2. The true beginning of the college orientation program is the first contact the college has with the student even at the junior high level or lower.
3. The Orientation-Week Programs within themselves are inadequate.
4. The orientation class and/or periodic counseling is the most appropriate organized follow-up of the Orientation-Week Program.
5. Parents are a most important consideration in this "orientation-separation" program.
6. The community makes a worthy contribution to the orientation of freshmen.
7. Well administered pre-college clinics and freshmen camps make a significant contribution to freshmen orientation.
8. The findings point strongly to use the student leaders in the orientation program.
9. Testing before and during the orientation-week seems to be the most popular. The future may see more testing before orientation-week.
10. Test interpretations should be a major concern before any testing is done.

II. Conclusions applicable to the Orientation-Week Program

1. Too much is often attempted in the program of a week.
2. The small group meeting is the most effective technique for the orientation of students.
3. According to this study groups organized around the major interests of the students were the most effective.
4. During the Orientation-Week Program emphases were placed on the significant college information sent earlier.
5. The student leaders help plan, organize, administer and evaluate the program within the framework established by the institution.
6. An effective way of introducing the student to all his academic activities in a day's time is to have classes meet for shorter periods as a part of the orientation program.
7. In this study the freshman wants to feel a "belongingness," but he should not have to select a fraternal organization during the Orientation-Week Program.
8. A goodly number of freshmen feel "mothered," bored or are confused by the present programs, and a high percentage of them experience a "let-down" feeling after the orientation-week activities are over and classes formally start.
9. Cordial attitudes on the part of college personnel is important, but finally effective techniques must be used in orienting college freshmen.
10. It was indicated to be a good practice, usually for the counselor to meet his counselees in a social situation first.

11. Usually not enough time is allowed for counseling.

12. Often the programs are not well organized and there is not sufficient competent help.

13. The college is "labeled" by its program.

III. Conclusions applicable to the organization, administration and evaluation of the Orientation-Week Program

1. Students were specifically included in the organization, administration and evaluation of the program.

2. Ex-officio members were necessary for over-all co-ordination with the total institutional program.

3. Continued evaluation was necessary either on the basis of stated objectives or more subjective criteria as, "What does our Orientation-Week Program tell the students about us?"

4. The lack of clear-cut written objectives seemed evident in many programs.

5. Repeated emphasis seem to be, "Set attainable objectives within the limits of the Orientation-Week Program."

Microfilm \$2.95; Xerox \$10.35. 227 pages.

ECONOMIC GROWTH OF STATES AS RELATED TO SHARE OF WEALTH DEVOTED TO PUBLIC EDUCATION

(L. C. Card No. Mic 60-6677)

Lamar Moody, Ed.D.
The University of Florida, 1960

The major interest of this study was directed toward the effect of the effort to support public education in the various states on growth of per capita personal income during the period 1945-1957. Did the taxing decisions for strengthening and extending the public school system since the end of World War II have an unfavorable impact on the economy during that period of time? That is, although it is assumed that the long-range effect of increased educational expenditure is favorable to economic development, was the temporary, short-range effect unfavorable?

This study was predicted upon two basic assumptions: first, the educational level of the people affects productivity; and, second, the initial level of economic wealth affects subsequent productivity.

The problem in this study was to examine the relationship between the effort to support public education in the various states and growth of per capita personal income during the period 1945-1957 when educational level of the people and the initial level of per capita personal income were held constant.

Two measures of educational effort were used in this study: one measure of effort used relates revenue receipts to ability as measured by personal income and is a percentage value; the other measure of effort was revenue receipts per child enrolled expressed in dollar units.

Two measures of economic growth were used; dollar growth of per capita personal income was used as one measure and per cent change of per capita personal income was used as the second measure.

The measure of educational level used in this study was the median number of school years completed by

persons aged twenty-five years and over as revealed in the 1950 census.

The degree of relationship among the variables considered in this dissertation was studied by means of calculating product-moment correlation coefficients. The analysis required the calculation of zero-order, first-order, and second-order coefficients of correlation.

No significant relationship was obtained between the measures of educational effort and the measures of growth of per capita personal income when differences among states in beginning level of per capita personal income and in educational level were partialled out.

The variation in educational effort showed no temporary unfavorable effect on the economy. When the per cent measure of effort was used, the signs of the correlation coefficients were negative, but the coefficients were so low as to be insignificant. When the dollar measure of effort was used, the signs of the correlation coefficients were positive, but the coefficients were so low as to be insignificant.

The evidence presented in this study did not reveal either a temporary favorable or a temporary unfavorable effect on economic growth of either a high or a low rate of investment in public education during the period 1945-1957.

Microfilm \$2.75; Xerox \$5.80. 119 pages.

A DESCRIPTIVE ANALYSIS OF A LEADERSHIP WORKSHOP

(L. C. Card No. Mic 60-5338)

Hugh Franklin Moss, Ed.D.
Auburn University, 1960

Supervisor: Truman M. Pierce

In 1958, the Southern Education Foundation wished to improve the leadership competence of principals and supervisors, to give practical experience to its graduate fellows, to help promote research at the local level, and to further understanding of the "Spirals of Change" theory at certain universities. Therefore, the foundation sponsored a workshop based on group-centered leadership principles and couched in a framework known as the "Spirals of Change," a theory of personal growth and social change. This theory is based on assumptions that people behave on the basis of the manner in which they see the world around them and that all people have a basic drive to enhance themselves.

PURPOSE OF THE STUDY

The purpose of the study was to report as objectively as possible on a summer workshop experience in terms of the leadership roles of the participants and the workshop staff. A second purpose was to report on a follow-up regional research project which was an outgrowth of the experiences of the workshop participants. This second aspect was specifically concerned with changes in roles of principals and supervisors who participated in the workshop and changes in teachers' perceptions of the roles of these principals and supervisors during a one year period following the workshop experience.

HYPOTHESIS

The workshop group advanced the general hypothesis that the leadership competence of principals and supervisors can be improved through a summer workshop based on group-centered leadership principles. Sub-hypotheses were advanced that after participation in the workshop, teachers' perceptions of the ordinary and ideal roles for principals and supervisors will coincide to a greater degree with the principals' and supervisors' perceptions of these roles. Also, that principals' and supervisors' predictions of the teachers' perception of the principals' and supervisors' ordinary role will agree to a greater degree with the teachers' perception of the principals' and supervisors' ordinary role.

METHODS AND PROCEDURES

During the course of the study, it was necessary for the writer:

1. To provide a framework to show the Southern Education Foundation's purposes for providing the workshop experience.

2. To include comprehensive information about staff pre-planning that was conducted to clarify the purposes set forth by the Southern Education Foundation and their own personal clarification of purposes for being involved in such a workshop. Related also was how the staff decided the workshop purposes could best be accomplished.

3. To give an account of the workshop experiences, such as: registration, the initial meeting, study groups, team projects, reading, general sessions, regional research project, and grading and evaluation.

4. To present the steps which led up to the workshop participants involving themselves in a regional research project.

5. To give the hypotheses for the regional research project, as well as basic assumptions made in instituting the project, the proposed plan of action for accomplishing the project, the implementation of the plan of action, and pertinent information about the population encompassed in the study.

6. To make a statistical report of the findings of the regional research project and to draw conclusions and make recommendations resulting from the study.

Principal's and supervisor's Role Concept Q-Sorts were the instruments used to measure perceptions and predictions of ordinary and ideal roles for principals and supervisors. The principals and supervisors sorted the instrument at the beginning and end of the school year. Each time they first described how they ordinarily behaved on the job. The second described how they would like to behave or what their ideal behavior should be. The third sort was a prediction of how they believed that their teachers saw them behaving on the job. The teachers made two sortings at the beginning of the school year and at the end. The first described how they perceived the principal or supervisor behaving on the job. The second described how they would like for him to behave or what his ideal behavior should be like in their opinion.

MAJOR CONCLUSIONS

The workshop was successful in being group-centered. There was considerable evidence that the roles being performed by principals and supervisors changed.

Some graduate fellows did participate in the workshop. However, there was not sufficient number to warrant a statement to the effect that the Southern Education Foundation's purpose was achieved.

The University Centers did not gain a better understanding of the "Spirals of Change" theory. This was another purpose of the Foundation which was not achieved.

Microfilm \$2.75; Xerox \$6.80. 142 pages.

THE HISTORY OF NEW MEXICO WESTERN COLLEGE

(L. C. Card No. Mic 60-5577)

Donald Sheldon Overturf, Ph.D.
The University of Nebraska, 1960

Adviser: Leslie Lee Chisholm

Statement of the Problem

As an administrative officer of the institution under study, the author has been aware of a definite need for the type of research conducted in this study. Modern faculty members and friends of the college are frequently not aware of the background of the institution and have needed this information as a foundation for a wholesome association with the college. Other education agencies, new faculty members, new members of the Board of Regents, and new students coming to the college have been in need of a complete history of the institution. Further, the events of the past should be recorded before they are completely lost and forgotten. The general history of the institution can well serve as the nucleus for the future development of a depository for important documents of historical value as the college grows.

The Procedure

In conducting the research a survey was made of most of the documentary material which exists in the official files of New Mexico Western College from its opening in 1894 to the present day. The study included a general history of the origin and development of the institution, an analysis of the educational and curricular development, an analysis of the administrative history and development, an analysis of the faculty and its contributions, an analysis of the physical plant, an analysis of the financial support, and a final analysis of the challenge for the future.

The study did not follow an ordinary chronological approach to the history of the institution. Rather a report was made on the history of each of the areas of the college operation as mentioned above with each individual analysis proceeding on a chronological basis within the topic concerned.

In the general history of the college the writer attempted to provide information on the setting into which the college was introduced in 1894.

In the chapter on administrative history attention was given to the history of the Board of Regents, the administrations of the various presidents, and the type of administrative organizations which have developed.

In studying the educational and curricular development an analysis was made of the history of the curriculum of

the institution, the educational philosophy, and the most significant historical developments in this area.

The analysis of the faculty was concerned with special consideration of the earliest faculty members, the contributions of the faculty, the history of the faculty meetings, the educational qualifications of the faculty, and a general overview of faculty activities.

The students who have attended New Mexico Western College were the subject for a chapter. Enrollment statistics were studied and analyzed. The types of students who have attended were described. The traditions and the activities of the students were outlined.

In the physical plant study an analysis was made of the history of each of the major buildings of the campus and most of the minor ones. The development of the campus real estate was also studied in some detail.

The final chapter of the study was concerned with the challenge that the future holds for New Mexico Western College. A brief prediction for the future of the institution was made in relation to the areas studied.

Summary and Conclusion

The research conducted for this study has resulted in the compilation of some card files of information which will be of great value in the administrative work of the college. Further, the final history has resulted in a drawing together of hundreds of facts into an organized, usable collection of material which not only tells the story of the institution but also presents a body of information which can be of great use to many people in the years to come. Lastly, the present history will provide the foundation for the recording of future events. Through an awareness of the past, all those associated with the college can now develop a better understanding of the present and then devise improved planning for the future.

Microfilm \$9.75; Xerox \$34.65. 770 pages.

PLANNING CENTRAL OFFICE FACILITIES FOR LOCAL SCHOOL DISTRICTS

(L. C. Card No. Mic 60-6713)

Norman Clifford Richardson, Ed.D.
Stanford University, 1960

PROBLEM

Administrative offices for local school districts have generally been housed in quarters inadequate for the specialized services performed. This study is concerned with the development of educational specifications as a communicative vehicle between school authorities and architects to insure more efficient structures.

SOURCES

A survey of related literature was made and summarized in the belief that school officials planning new administrative offices would benefit from a readily accessible list of selected references. Conferences with architects and educational consultants afforded suggestions as to the function, preparation, and interpretation of educational

specifications. Visitations to twenty-two administrative offices in three states provided a direct source of information for making analyses of pertinent data.

PROCEDURES

A four-step approach in the consideration of the problem included: first, presentation of a representative administrative organization and program of activities for a medium-sized school district; second, suggestions for membership in the planning groups and roles to be played by each member in the planning processes; third, development of a logical structure for educational specifications, based on specific planning factors; and fourth, development of sample educational specifications for an administrative office building as an application of the core of the study.

FINDINGS

Results of the study supported the assumptions that a lack of proper educational planning, involvement of building personnel in the planning process, and written educational specifications were prime reasons for administrative building inadequacies.

Analysis of administrative activities and services disclosed several significant trends which have not generally been suitably accommodated in central office housing:

1. Expanding educational programs and enrollments have created a need for more and better central office facilities.
2. Instructional materials centers have been centralized in professional libraries, audio-visual centers or combinations of the two.
3. An increase in the number and variety of curriculum specialists is a reflection of a recognition of the need for educational leadership in improving instruction.
4. Widespread involvement of teachers in curriculum development and improvement has given rise to curriculum laboratory facilities.
5. Increasing importance is being given to psychological and health services and to the education of handicapped children.
6. Expanded business operations have caused districts to turn to the use of modern office machine equipment.
7. Certain spaces not in continuous use have been given multiple use in the interest of economy.
8. Visual and aural privacy have not been considered essential in all central office spaces.

RECOMMENDATIONS

The following recommendations were made for planning local school district administrative offices:

1. That the ideal solution in providing facilities to support the educational program is to provide a separate building designed specifically to house the unique administrative activity.
2. That educational leadership and services be accommodated in the administrative offices by centralization of instructional materials and provision of work space for curriculum improvement.
3. That coordination and administration of such activities as psychological, health, and special education services be centered in the school district office.

4. That the board meeting room be located, equipped, and decorated to promote desirable attitudes toward the schools, and that it be planned for uses other than board meetings.

5. That superintendents' offices be attractively furnished and decorated to provide an atmosphere of cordiality and confidence.

6. That, with change and growth main characteristics of central office programs, flexibility be an important structural feature.

7. That comfort, health, and convenience of building personnel not be sacrificed for economy in provision of building service installations, color planning, and sound control.

CONCLUSION

The planning of a central office facility for local school districts offers professional educators an opportunity to engineer definitely controllable factors to the end that the plant becomes a positive educational force.

Microfilm \$3.35; Xerox \$11.70. 260 pages.

THE INTERNAL ADMINISTRATIVE ORGANIZATION IN HIGH SCHOOL MUSIC EDUCATION

(L. C. Card No. Mic 60-4510)

Paul Francis Roe, Ph.D.
The University of Nebraska, 1960

Adviser: Leslie L. Chisholm

The Problem

The purpose of the present study is to determine the status of administrative practices in music education in public schools and to discover promising practices and recent trends.

The Procedure

The procedure consisted of nine parts: review of literature, inquiry concerning willingness to participate in the study and provide essential data, preparation of a checklist or questionnaire to be sent to a jury of experts, personal interviews with officials in a selected number of schools, careful preparation of an interview questionnaire to be mailed to a larger number of schools, and tabulation, organization, presentation, and interpretation of the data.

From recommendations of the nineteen state chairmen of the North Central Association of Colleges and Secondary Schools, 123 public high schools, recommended for their music departments, were contacted. One hundred five schools answered the seventten page questionnaire. There was a fairly even distribution between schools of under 400 in size, 400-700, and over 700.

The study included activities concerning (1) pupils, (2) promotional activities, (3) curriculum and scheduling, (4) finance, (5) music and equipment, (6) records, (7) business procedures, (8) general administration and teaching forces, and (9) best practices suggested by schools.

Findings and Conclusions

Small schools found it easier to schedule music and instrumental departments had less difficulty than choral departments.

Schools above 400 population used glee clubs more often as training groups. Schools under 400 used glee clubs more often as performance groups. The strong trend of recent years toward mixed vocal groups was again apparent.

Many instructors used performance tests and written tests. Very few standardized tests were given.

Recruitment of students becomes increasingly necessary. Leading ways to recruit were: personal contact of good students; recommendations obtained from junior high school teachers; parent conferences; telephone calls, postcards, and letters to good students.

In publicizing musical events, the newspaper article was used most frequently.

Although most schools reported regular period classes, two-fifths of advanced boys glee clubs were meeting outside school time.

Teaching music fundamentals in performance groups seems to have become increasingly essential, as most schools were without sufficient instructors for separate classes.

Free summer school sponsored instrumental classes were the rule. There was some experimentation with voice classes and summer choruses.

Many schools still partially finance their department through other sources than school district funds.

Except for marching bands, most music departments purchased one copy of music for two students. Instructors used folios, distributing and collecting them usually by pigeon-holed cabinets in instrumental classes and by monitors in vocal classes.

Two-thirds of the instructors did not allow substitution in bid orders.

Most departments used awards for motivation.

Personnel for performance groups was usually selected on the basis of tryouts, balance needed, recommendations, tests, and grade level.

Twelve of the 105 schools regularly had assembly singing. One-fourth of the high schools made no provision for the student with low musical ability. Most performance classes met five times a week.

Directors generally permanently marked uniforms and robes, inspected instruments twice a year, and had uniforms and robes cleaned yearly. Usually recorded were: cost of instruments, model numbers, cases, finishes, materials, and accessories.

Teachers listed (a) title, (b) composer, and (c) classification in the card file. Title, composer, arrangement, publisher, type, file number, number of copies, and octavo number were ordinarily marked on inventory cards.

Students participated in the administration of the music activities in many ways.

Information most frequently kept on students was: name, instrument played, voice part sung, telephone number, and grade in school.

Microfilm \$3.15; Xerox \$11.05. 241 pages.

A STUDY OF FACTORS AFFECTING THE
MUSIC PROGRAMS OF JUNIOR AND
SENIOR HIGH SCHOOLS IN
FAIRFIELD COUNTY, CONNECTICUT.

(L. C. Card No. Mic 60-5250)

Robert Arnold Rowe, Ph.D.
The University of Connecticut, 1960

Purpose of this Study

It was the purpose of this study to investigate the present status of music in the junior and senior high schools of Fairfield County, Connecticut, ascertaining to what extent music programs had been affected during the last decade by such factors as efforts being made to "stiffen" the curriculum in the areas of science, mathematics, and languages; trends toward the elimination of "frills," the addition of new subjects into the curriculum, more rigid college entrance requirements, double sessions, over-crowded schools, economy-minded taxpayers, and shortages of public school music teachers in the area.

Method of Collecting Data

Three pilot questionnaires were constructed and submitted for critical evaluation to a jury of five experienced Fairfield County music supervisors and, based upon their criticisms, revised for use as data-gathering instruments. A fourth questionnaire for guidance officers was designed to locate possible evidence of a significant reallocation of educational time in the present school curriculum.

In order to obtain data not readily susceptible to inclusion on a questionnaire and to secure additional data as the study progressed and significant trends appeared, personal interviews were held with each music supervisor taking part in the study. The ability of Fairfield County to afford high quality education was analyzed in a chapter devoted to an economic profile of the county.

All the data gathered from this study, and from a similar study made by members of the Connecticut Music Educators Association in 1948 was organized and tabulated. Based upon the data, conclusions were drawn and recommendations made for bettering the position of music education in the years ahead.

Findings

A comparison of school music programs in 1948 and 1958 revealed the latter to be (1) of greater breadth and more varied in the musical experiences provided by the syllabus; (2) more frequently taught by a music specialist; (3) enjoying facilities better suited to music's special needs; and (4) equipped with more adequate instructional supplies and equipment.

Student participation in all elective music offerings, with the sole exception of junior high instrumental music, had diminished to a significant degree during the decade and to an alarming degree in the past year. Students were dropping out of the music program with increasing frequency, particularly at the end of grades six and nine, with those defecting concentrated into three groups--boys, ninth graders, and the higher ability, college-bound students.

Conspicuous weaknesses were noted in (1) the syllabus for junior high general music--largely restricted to singing and music appreciation; (2) the inadequate program provided ninth graders; and (3) the emphasis placed upon bands, selective choral groups, and girls' choruses at the expense of the orchestra, large elective choruses, and choral organizations for boys.

The music program, failing to compete effectively with the enriched and accelerated courses in science, mathematics, languages--and such newcomers to the high school curriculum as remedial reading and driver education--was being allotted a smaller share of educational time and might soon become an extra-curricular subject.

Public school music has been damaged--severely in some schools--by double sessions, scheduling policies, the old cry of "frill," and cut backs in spending. However, it seemed to be suffering most of all from the post-Sputnik philosophy held by boards of education, administrators, and teachers exemplified by the slogans "pile it on" and "beef it up." In spite of good intentions, excesses have inevitably resulted.

Increased competition for college admission, rather than more rigid entrance requirements, has caused many high school students to fill their schedule with full time subjects, thus leaving no remaining time for electives--such as music.

In summation, it seems evident that music faces a critical period. In some schools it must wage a determined fight for survival.

Microfilm \$2.75; Xerox \$6.60. 138 pages.

VOTER TURNOUT IN SCHOOL
FINANCIAL ELECTIONS

(L. C. Card No. Mic 60-6714)

William George Savard, Ed.D.
Stanford University, 1960

Purposes

This study has three general purposes:

- (1) To describe the patterns of turnout in school financial elections.
- (2) To explore the relationship between variations in turnout and the outcome of school financial elections.
- (3) To examine possible causes of variation in turnout.

Methodology

Financial election histories were collected from 82% of a random sample of 1054 school districts stratified by size. The data were processed, tables of means and standard deviations prepared, and variability was tested by the variance ratio technique.

The Findings

Turnout at school financial elections was found to be generally low. It is hypothesized that the low level of

turnout is related to low feelings of efficacy for the review of policy by voters.

It was determined that turnout is strongly related to outcome. Mean turnout at elections which failed was significantly higher than at elections which passed. Low turnout was related to success, medium turnout to failure. High turnout was related to almost equal proportions of success and failure with a slight margin favoring success.

Turnout was found to be inversely related to enrollment size of district. Turnout also varied by type of election, whether bond or tax, and type of schools operated by the district. A finding that turnout varies by geographical region suggests the need for local norms. The lack of trends in turnout over the past several years suggests that the apparent increase of interest in public education may be limited to a vocal minority. Turnout at bond elections was found to be directly related to the amount of the issue. The proportions of funds from state and local sources was also found to affect turnout.

An examination of the effects on turnout of certain legal variables in different sizes of districts suggests a pair of complementary hypotheses. In larger districts legal and political arrangements which allow greater control by the board and administration result in higher turnout. In smaller districts legal and political arrangements responsive to the voter result in higher turnout.

Implications for Further Research

The findings suggest that further research into the effects of legal variables might be profitable. The relationships between the responsiveness of the system to the voter, communication problems, and turnout need further examination. A study of the effects of controversial issues on turnout and outcome is called for. The highly significant variability in turnout associated with many of the situational and legal variables investigated emphasizes the necessity for controlling for situational and legal characteristics in any future studies of turnout.

Microfilm \$2.75; Xerox \$9.00. 197 pages.

PROCEDURES AND FACTORS INVOLVED IN THE SELECTION OF INDUSTRIAL ARTS TEACHERS AND THEIR RELATIONSHIP TO RATED TEACHING SUCCESS

(L. C. Card No. Mic 60-6820)

Harlan Leonard Scherer, Ed.D.
University of Missouri, 1960

Supervisor: Dr. Walter C. Brown

Purpose of Study: The purpose of this study was to ascertain the selection procedures and factors employed by school administrators when selecting industrial arts teachers and to evaluate the selection procedures and factors by the subsequent rated teaching success of the teachers selected.

Method of Research: Data utilized in this study were obtained from information forms sent to school superintendents, personnel officers, industrial arts super-

visors, and school principals. Data was tabulated and chi-square tests calculated by the Computer Service, University of Missouri.

Summary: The majority of the respondents usually or always held personal interviews, required applicant to submit transcript of credit, required proof of legal certification, required applicant to fill out formal application blank, and collected information and opinion from persons named as references.

Over 50 per cent of the school systems would not consider further an industrial arts candidate if he were not well qualified on: (1) recommendations from teacher education institutions, (2) recommendations from former school officials, (3) personality, (4) health, and (5) professional attitude.

The rated success of the 205 industrial arts teachers included in the study tended to be skewed toward the higher ratings.

A statistically significant difference was found to exist between teachers with graduate credit and those without graduate credit, the higher ratings being attained by teachers with graduate credit.

The recruitment procedure, "depended upon interested applicants sending inquiries on their own initiative," was found to have a significant relationship with the subsequent success of the teachers selected. However, schools seldom using this procedure employed a greater number of the top rated teachers.

Statistically significant differences were found between teachers selected by school systems that required applicants to take written examinations or used the interview for an oral examination on the subject matter. However, both of these procedures were seldom or never used in the selection of the majority of the top rated teachers.

Statistically significant differences were found to exist between teachers selected by school systems employing the selection factors, qualifications for extra-curricular activities and scholarship in professional education courses. However, the first factor, when given little emphasis, resulted in the employment of the majority of top rated teachers, whereas, the second factor, when used to eliminate teachers from further consideration, resulted in the employment of the higher rated teachers.

Conclusions: From the statistically significant difference found it may be concluded that graduate work appears to have a positive relationship with the rated teaching success of industrial arts teachers.

The use of recruitment procedure, "depended upon interested applicants sending inquiries on their own initiative," offers no promise of securing top rated industrial arts teachers.

It appears that the use of written examinations have little value in the selection of industrial arts teachers and subsequently could not be employed to select the top rated teachers.

The use of the interview for an oral examination on the subject matter field offers little promise for the selection of the top rated industrial arts teachers.

There was a tendency for teachers that were evaluated upon recommendations from employers other than school officials, rating as a student teacher,

personality, and professional attitude to receive higher ratings. However, these selection factors were not statistically significant and can not be used as specific items upon which to secure the top rated industrial arts teachers.

The selection factor, "scholarship in professional education courses," should be employed as one of the factors upon which prospective industrial arts teachers may be evaluated.

The selection factor, "qualifications for extra-curricular activities," should be given little emphasis or not used in the evaluation of prospective industrial arts teachers.

Microfilm \$2.80; Xerox \$9.70. 214 pages.

**OPINIONS OF SELECTED INDIANA
SCHOOL OFFICIALS TOWARD
JAMES B. CONANT'S RECOMMENDATIONS
FOR AMERICAN HIGH SCHOOLS**

(L. C. Card No. Mic 60-6065)

Paul Marland Schilling, Ed.D.
Indiana University, 1960

Chairman: Maurice E. Stapley

This study represents an endeavor to appraise the opinions of selected Indiana school officials toward James B. Conant's recommendations for American high schools. The opinions were systematically analyzed to determine: (1) the extent of their favorableness or unfavorableness toward each of the recommendations, (2) whether the selected school officials were more favorable toward some of the recommendations than toward others, (3) how the opinions of the selected secondary school principals, superintendents, and school board presidents toward the recommendations compare with each other, and (4) the relationship of selected background factors to the opinions of the selected school officials.

The population of this study consisted of the secondary school principals, school superintendents, and school board presidents of Indiana school corporations that operate secondary schools which enroll 500 or more students in grades nine through twelve and are members of the North Central Association of Colleges and Secondary Schools.

The data for this investigation were obtained through the administration of an information sheet and opinionnaire. The respondents were asked to express opinions toward Conant's 21 recommendations for American high schools by checking: strongly agree, not sure--probably agree, not sure--probably disagree, or strongly disagree. An index of favorableness toward each of the recommendations was obtained by assigning values of 100, 75, 50, and 25, respectively, to the responses. These data, tabulated by frequency and percentage, were presented in table form. The selected secondary school principals and school superintendents' opinions were also classified and analyzed in accordance with the following five background factors: major teaching area, administrative experience, professional preparation, age, and size of school. The background factors which were used to classify the selected

school board presidents' opinions were: occupation, years of experience as a board member, age, years of formal education, and size of school. Additional tables were presented showing the relationship of selected background factors to the opinions of the selected Indiana school officials toward the proposals. All computations were performed by International Business Machines equipment and/or other electrical computing machines.

As a composite group the selected school officials expressed a high degree of favorableness toward 20 of the recommendations. The recommendations receiving an index of favorableness of 75 or more, in descending order, were: twelfth grade social studies (94), developmental reading program (93), summer school (91), diversified program (91), prerequisites (91), highly gifted pupils (89), academic inventory (88), counseling system (88), special consideration for slow readers (86), required programs (86), programs of the academically talented (86), science courses (83), supplement to diploma (82), academic honors list (81), homerooms (81), English composition (80), ability grouping (80), foreign languages (78), organization of the school day (78), and rank in class (76). Although the remaining recommendation--individualized programs--received an index of 69, it was still approved by a majority.

The classification of the officials' opinions in accordance with the selected demographic factors revealed that, generally, the opinions of the younger principals and superintendents tended to be more favorable than those of the older principals and superintendents, and principals and superintendents with a few years of experience were more favorable than those with many years of experience. Analysis of the opinions of the school board presidents indicated that those who were young and/or employed in clerical and sales, skilled, or housewife occupations were most favorable.

In general, the 201 selected Indiana school officials expressed a high degree of favorableness toward Conant's recommendations for American high schools.

Microfilm \$2.75; Xerox \$7.40. 157 pages.

**AN ANALYSIS OF PURCHASING PRACTICES
IN SMALL SCHOOL SYSTEMS OF TEXAS**

(L. C. Card No. Mic 60-6165)

Mayron Shields, Ed.D.
North Texas State College, 1960

The purpose of this investigation was to make a study of the practices used in the purchasing of school supplies in the small school systems of Texas.

Fifteen principles for purchasing school supplies were developed by Thomas C. Little in his study entitled The Administration of School Supply Purchases in Kentucky. Little used these principles to measure the efficiency of school supply purchasing in the state of Kentucky. A check list was prepared by rewording and rearranging the score card developed by Little.

Copies of the check list were mailed to each of the 252 schools in the sample. The sample included all the independent school districts in Texas with an average daily attendance ranging from 465 to 1,000 students. Usable returns were received from 204 of the schools for an 81 per cent return.

An interview schedule was constructed and interviews were conducted in twenty of the 204 schools that completed the check list.

An hypothesis was stated in Chapter I. It was based on the score card as developed by Little, and the maximum score as it was weighted was 1,000 points.

The hypothesis, as stated, was that no school would score 900 or more points for a rating of "excellent." The highest score was 890 points. It also stated that no school would score 800 or more points for a rating of "good." Five schools scored 800 or more points. A third prediction was that the median score would fall within the "very poor" range, below 600 points. The median was 550. Fifty-seven per cent of the 204 schools rated a "very poor" score. The range for the total scores was a low of 260 points and a high of 890 points. The average score was 581 points.

An analysis of Chapters III and IV disclose the findings as they relate to each of the fifteen principles. The conclusions are drawn from this analysis.

1. Superintendents are charged with the responsibility of purchasing school supplies in the small schools of Texas. In a majority of these schools the authority to perform this function is assumed by the superintendent. Policy statements in a few schools contain a brief paragraph that delegates the authority to purchase supplies to the superintendent. By either method the superintendents are charged with a responsibility without adequate authorization.

2. Supplies are not purchased in an efficient and businesslike manner. Poor techniques for maintaining inventories and determining the quantity and quality of supplies to be ordered are employed. Supplies are purchased on the open market and bids are not solicited. The techniques and practices used by industrial and business firms to purchase supplies have not been adopted by the small schools of Texas.

The following recommendations are made in the light of the foregoing conclusions:

1. The final authority for purchasing school supplies should be delegated to the superintendent. This delegation of authority should be expressed in a comprehensive written statement. It should explain the procedures to follow when supplies are requisitioned, bids are let, and contracts are awarded. Furthermore, it should explain the preference, if any, to be given local merchants when orders are placed. Policy should also state the payment procedures to be employed and clarify the method to be used when emergency and/or supplementary purchases are made.

2. A concerted effort should be made to acquaint the purchasing officials in these schools with the current research and good practices used in purchasing school supplies. Joint meetings with the Texas Association of School Business Officials should be helpful. Workshops should be conducted throughout the state to introduce these approved techniques and practices to these purchasing officials. Microfilm \$2.75; Xerox \$7.40. 158 pages.

THE INFLUENCE OF THE TYLER JUNIOR COLLEGE ON THE FINE ARTS CULTURE OF TYLER, TEXAS.

(L. C. Card No. Mic 60-6633)

Robert Gebhardt Sidnell, Jr., Ph.D.
The University of Texas, 1960

Supervisor: C. C. Colvert

Hypothesis. Recent emphasis on the community service role of the public junior college led to the hypothesis that such an institution can act as an influential factor in the evolution of a community's fine arts culture. As a community-centered, community serving institution, a public junior college should contribute actively to the development of and support of fine arts organizations and presentations in its community. Furthermore, necessary leadership and sponsorship of various fine arts activities can be forthcoming from the local public junior college through the utilization of its faculty and physical plant. Tyler Junior College and the community of Tyler, Texas, were selected as the college and community to be studied.

Methodology. It was necessary to discover the past and present status of the fine arts culture of the community where the public junior college was located and to record opinions regarding the influence of the college on the fine arts culture. In addition, stratification, according to socio-economic class, of a random sample of the general population of the community was accomplished in order to determine the universality of the influence of the public junior college.

In order to obtain data relative to the above questions, the following procedures were employed.

Review of Literature. A review of pertinent literature dealing with various aspects of the problem was undertaken.

Faculty Questionnaire. A questionnaire was sent to the full- and part-time members of the junior college faculty. Inquiry was directed to the interaction of these individuals with various phases of community life, particularly the fine arts culture.

Structured Interview. A structured interview was held with educational and fine arts leaders in the community regarding the fine arts culture and the contributory role of the public junior college.

Sample of the General Population. A random sample of the general population was drawn and polled regarding the contributions of the junior college to the community fine arts culture. Stratification of this sample by the North and Hatt Occupational Prestige Scale yielded data relative to socioeconomic class and the various aspects of the problem under study.

Findings. Of music, drama and art, music was found to be the most developed art form in the community. Similarly, the program of the junior college in music was the most advanced. Increases in enrollments and curricular offerings were evident in the junior college program. Significant also was the participation of the music faculty members of the junior college in community fine arts events, e.g., conductor of the local symphony orchestra.

Drama and arts were found to be less developed both in the community and the junior college program. According to the various groups questioned, it was indicated that as the junior college gained permanence these fine arts forms would receive increased emphasis and grow in frequency in the total community fine arts culture.

All of the groups questioned (faculty, the educational and fine arts leaders, and the sample of the general population), indicated in varying degrees, that the junior college had influenced fine arts culture in the community.

The result of the stratification of the general population sample revealed that the Upper Class rated the junior college influence the greatest among the various social classes. In addition, the Upper Class indicated the largest frequency of enrollment at the public junior college. The Middle Class indicated the next greatest degree of influence of the junior college on the fine arts culture among the socioeconomic classes. The Lower Class reported only a very small number of enrollments at the junior college and rated the institution's influence on the fine arts culture as "very little."

Microfilm \$3.60; Xerox \$12.60. 280 pages.

A STUDY OF THE FACILITIES CONTAINED IN THE TWELVE MOST RECENTLY CONSTRUCTED JUNIOR HIGH SCHOOL BUILDINGS IN NORTH CAROLINA

(L. C. Card No. Mic 60-6997)

Ray Brewer Sizemore, Ed.D.
The University of North Carolina, 1960

Supervisor: Guy B. Phillips

It was the purpose of the study to discover and reveal the type and variety of facilities contained in the twelve most recently constructed junior high school buildings in North Carolina and to reveal trends evident in the planning and construction of these buildings. It was also the purpose of the study to compare the facilities contained in the twelve buildings with the facilities recommended by selected school planning authorities as needed in order to provide for the fulfillment of the functions of the junior high school.

Each of the twelve buildings studied was visited two or more times, and a study was made of the facilities contained in the buildings. Data gathered were recorded on two forms designed for that purpose.

The functions of the junior high school, as they related to the school facilities, were identified and traced through the fifty years during which the junior high school has existed as a separate division of the public schools. It was shown that the functions of the junior high school have changed considerably over the fifty-year period and as they have changed the facilities needed to provide for their fulfillment also changed.

The facilities contained in the twelve buildings studied were described in considerable detail. Particular emphasis was placed on the size and variety of spaces included in these buildings as well as the equipment and furniture provided. Suggestions and ratings by teachers in each of the twelve schools regarding how well their

particular building and school program provide for the fulfillment of the functions of the junior high school were presented.

The trends noted in the summary of the facilities contained in the twelve most recently constructed North Carolina junior high school buildings were compared with the recommendations of selected authorities in the field of school planning. Evidence was presented which shows the trends in these twelve buildings to be similar to those evident in the recommendations by the selected authorities. It was apparent that an individualistic approach by each community in selecting sites, determining the type of plans for the school buildings and planning the facilities to be included has almost completely replaced the "stock" plan approach. A definite trend toward buildings constructed around a skeletal frame, buildings which are spacious, attractive and flexible was clearly indicated. It was also noted that the North Carolina buildings fail to provide adequate facilities for guidance. A final conclusion pointed out that a majority of the North Carolina junior high school teachers are trained as elementary or as high school teachers and that even after entering the junior high school field receive little in-service training for that school division.

It was recommended that greater emphasis be placed on the practice of providing the architect with complete educational plans before asking him to plan a building; of utilizing available professional services in the field of school planning; and planning for probable but unknown modifications and additions of the building.

Microfilm \$4.70; Xerox \$16.65. 366 pages.

BASIC PRINCIPLES AND PRACTICES AS A GUIDE FOR PUBLIC SCHOOL PROCUREMENT

(L. C. Card No. Mic 60-6069)

Leonard Vernor Taylor, Ed.D.
Indiana University, 1960

Chairman: Dr. Raymond C. Gibson

The problem. The problem was to develop a basis or guide for an efficient procurement program for supplies and equipment in the public schools.

To achieve this objective it was necessary to secure answers to the following questions concerning procurement: (1) What is the best organization for efficient procurement? (2) How is the quality of supplies and equipment determined and by whom? (3) What are the types of inspection and tests of quality that assure compliance with quality ordered? (4) What are the desirable procurement policies and procedures? (5) What system of storage, issue, and control is desirable?

Procedures. A careful and critical search of the literature on school, industrial, and governmental procurement was made to secure basic principles and practices of procurement.

From the principles found in the literature a checklist was developed covering the essential principles. This checklist was submitted to a "panel" of specialists in procurement from large city school systems for rating

and suggestion. The checklist was submitted to the "panel" for two purposes; (1) to ascertain whether industrial and governmental principles were applicable to schools, and (2) to have the principles rated on the basis of their contribution to good procurement on a four point scale of indispensable, very important, of some importance, and of no value.

The checklist was then used as an interview guide to study the practices in schools in Indiana with a pupil population of 3,000 to 6,000. The purposes of interviewing officials of these schools were to see whether the principles were applicable to small schools and to secure suggestions for improvement of the checklist.

The checklist was further refined and subdivided to serve as a guide for the establishment and improvement of procurement programs in the public schools.

Findings. The major findings were that:

1. Principles and practices of industrial and governmental procurement can be and are used in school procurement.

2. There is a basic framework of procurement principles and practices that applies to all types of procurement.

3. Schools have not developed standards of quality for school materials, but depend on the manufacturers to establish such standards.

4. Schools need to do more and better testing of quality.

5. School-owned testing equipment was very inadequate in the schools studied.

6. In the schools studied there was a general lack of knowledge concerning tests and testing.

Conclusions. The major conclusion drawn from this study is that the general procurement principles and practices are the same for all types of procurement, and that a list of these principles and practices would serve as a guide for the establishment and/or improvement of procurement programs in the public schools.

A checklist was developed as a guide for establishing and evaluating procurement programs in public schools.

Some general conclusions to be drawn from the practices of the schools studied are as follows:

1. Improvement could be made by school boards in the area of written school policy and delegation of authority.

2. A better organization could be provided for simplification, standardization, and selection of materials.

3. More schools should buy from the lowest bidder that meets specifications rather than from local bidders at higher prices.

4. The testing program as carried out in the schools studied could be improved.

5. Services of commercial testing laboratories should be used to a greater extent.

Microfilm \$3.30; Xerox \$11.50. 254 pages.

PERCEIVED FACTORS IN THE SCHOOL-COMMUNITY RELATIONSHIP AND SCHOOL FINANCIAL SUPPORT

(L. C. Card No. Mic 60-6715)

Francis Marion Trusty, Ed.D.
Stanford University, 1960

This study describes the relationship of voter approval of school bond and tax issues to perceptions by superintendents, board members, mass media spokesmen, school supporters, and school critics of the effect 162 factors have in large, medium, and small school districts.

Methods of the Study. The 162 factors in the factor evaluation inventory are from 15 content areas and were perceived as operating by two or more informants in at least one community. The data were collected by mailing inventories to informants in small, medium, and large districts, who were in a position to know the effect these 162 factors have in the local school-community relationship. Some 1046 informants in 209 success districts and 180 failure districts responded to the inventory. Each informant answered three questions about each factor: (a) Does this item make a difference in school-community relations? (b) If so, does it contribute to success or failure? and, (c) If the item does make a difference in school-community relations, how important is it? In answering the third question the informant had two choices: "of some importance" and "very important." The factors were ordered by district size and by informant type using the correlation coefficient K. The factors were then rank-ordered by district size and informant type. These analyses indicate the relationship of perceived effect of factors to financial success records, and are, therefore a critique of the informants judgments. Informants best judgments are defined as those factors perceived as helping in success communities or hurting in failure communities and informants worst judgments are defined as those factors perceived as hurting in success communities or as helping in failure communities. Informants' judgments were then correlated by using the Spearman rank method of correlation to determine the similarity of judgments by size of district and type of informant.

Findings. The data show that size of district and type of informant are important in judgments of school-community relations. Informants' best judgments in large and medium districts are on opposition groups and voter attitudes on financial matters. In small districts, informants' best judgments are on school board policies, district personnel, and instructional practices. In all size districts, informants' worst judgments are related to communication efforts of the schools and of citizen committees during election campaigns. The findings for informant types are similar to findings for district size. The best judgments of informants have to do with factors perceived mostly as hurting in failure communities each as critics, critic techniques, voter attitude, and community characteristics. The data show that worst judgments by informants with the occasional exceptions of school critics, are most often shared on communication activities of the schools and citizen committees in election campaigns. The worst judgments of superintendents, board members, mass media spokesmen and school supporters are on factors seen as helping in failure communities. The worst singular judgments of informants tend to be on communication activities, relations between people, growth of schools

and on factors having to do with quality of special services.

Conclusions. Size and informant type makes a difference in school-community relations. In large and medium districts the flow of information is more difficult. This difficulty tends to block agreement on what the situation is, and makes for misunderstanding. Communication agencies tend to emphasize differences which results in communicating controversial aspects of school-community relations. It is probably easier therefore for informants to judge what is communicated and visible than what is not communicated. Also, that citizen committee activity is usually an emergency measure to secure voter support.

Further research is needed to determine the communication patterns in large, medium and small districts. Further, the processes of communication need to be studied to determine how informants achieve similarity of perceptions. Microfilm \$2.75; Xerox \$6.20. 127 pages.

AN EXPERIMENT IN ELEMENTARY SCHOOL REORGANIZATION FOR EDUCATIONAL TELEVISION IN WICHITA, KANSAS.

(L. C. Card No. Mic 61-288)

Benny W. Wolfe, Ed.D.
University of Kansas, 1960

1. **Background of the Study.** Dr. Stoddard, representing the Fund for the Advancement of Education, proposed a plan whereby elementary schools might effect teacher economy by teaching students for part of the day in large groups. Television lessons were to aid in this large group instruction. This study concerns the trial of this plan at one Wichita, Kansas, elementary school.

2. **Purposes of the Study.** (1) To determine what economies can be made as a result of using the general reorganization plan for educational television proposed by Dr. Alexander J. Stoddard. (2) To identify and describe the organizational problems which arise when the reorganizational plan is used in an elementary school. (3) To find what happens to the learning-teaching situation when the Stoddard formula is used in an elementary school.

3. **Procedure.** The costs of personnel, building and equipment under the experimental plan were compared with the costs which would have been anticipated under conventional organization.

To identify and describe the organizational problems detailed notes were kept during the development and operation of the plan.

To find the effect of the new plan on the pupil's development the California Achievement Test was used to compare the gain of students under the experimental organization with the gain made by pupils in a control school. Also teachers and pupils were interviewed to find their attitude toward the new organization.

4. **Findings.** Excluding the cost of television programming, the reorganization caused a personnel saving of 20 per cent. Savings of 18 per cent were made in the classroom space needed. There was a saving of five dollars a pupil in furniture requirements.

Including the estimated cost of central television studio equipment, the net savings of reorganization are dependent upon the enrollment size; the number of schools involved; the type of television equipment and the remodeling necessary for large groups.

Little saving could be made by the reorganization of the Wichita elementary schools with existing auditoriums when the costs of central studio facilities are considered.

The reorganizational plan set inflexible time blocks. It was difficult to fit some subject areas into these time blocks. Other problems were: finding personnel to teach the activities assigned to special rooms and the correlation of subject content assigned to more than one teacher.

As measured by the California Achievement Test the children in the experimental program achieved as well as those children in a control school, matched on the basis of grade, I.Q. and sex.

The teacher of the large groups believed the teaching load was much heavier than that of the self-contained classroom. The basic room teachers believed they could teach, in two groups a day, a total of 42 pupils about as easily as they could 30 pupils in the ordinary self-contained classroom. The basic room teachers believed the new program made their work more "efficient" by the use of teacher aids and the assignment of physical education, music and art classes to special room teachers.

5. **Conclusions.** Problems related to the economy of elementary school reorganization need further study. What percentage of the central studio cost should be charged to the elementary program when intermediate and high schools share the use of the studios? What would be the cost of reducing the teaching load of the large group teacher?

Some efficiencies for the basic room teacher are indicated by their belief that more pupils could be given instruction with equal effort than under the self-contained classroom organization.

The effect of the new organization on the emotions of children was not clear.

The popular belief that the self-contained classroom provides a better setting for the total development of the child needs to be examined in a closer relation to the class size and teacher effectiveness.

Microfilm \$2.75; Xerox \$7.60. 161 pages.

AN ANALYSIS OF NATIONAL AND STATE PUPIL TRANSPORTATION WITH SPECIAL EMPHASIS ON COST FACTORS IN TEN SELECTED MICHIGAN COUNTIES

(L. C. Card No. Mic 60-6973)

Wayne Dean Woodby, Ed.D.
Michigan State University, 1960

Major Professor: Wm. Roe

The steadily increasing importance of pupil transportation coupled with legislative restrictions on amount and distribution of financial aid motivates an analysis of pupil transportation cost factors as a guide to Michigan school districts engaging in pupil transportation.

Statement of the Problem

The purpose is: (1) to ascertain on the national level the present and future status of pupil transportation; (2) to identify and categorize costs of pupil transportation in Michigan into major and minor factors and analyze each in relation to the whole; (3) to examine the structure and operation of the Transportation Code of 1957, with an analysis of the four types of allowances for state aid to transporting school districts; and (4) to suggest specific recommendations in the light of the findings.

Methods, Techniques, and Data

The writer surveyed the 48 states to determine the present status and to gain an estimate of the future.

Information was obtained from libraries relative to material already published on the subject.

The transportation reports of ten selected Michigan counties were then analyzed in the light of the relative value of the ten categories of costs.

A follow-up study was then carried out by questionnaire and interviews with administrators in these ten selected counties.

Conclusions

One conclusion standing out above all was that pupil transportation is a growing and dynamic area of school administration which merits continued attention.

On the national level two additional conclusions were evident. The first was a recognition of the need for improving the quality of pupil transportation through such devices as: (1) in-service and pre-service training of bus drivers; (2) standardization and refinement of school bus insurance practices; (3) adoption of recommended and tested state practices resulting in improved transportation; and (4) a better understanding of school transportation liability.

On the state and local level the study revealed that there were four major and six minor costs of pupil transportation. The major costs were: (1) Driver's salaries (44.69%), (2) Depreciation (20.50%), (3) Total Maintenance (15.89%), and (4) Gasoline (9.22%). The six minor costs collectively amounting to less than ten per cent were as follows: Administration, Insurance, Tires, Interest, Oil, and Driver Education.

The study revealed that metropolitan schools differed from non-metropolitan schools in that they operated on a relatively lower per capita cost basis and a higher cost per mile basis. Multiple bus routes were found feasible in school districts which averaged less than one hundred annual miles per student.

It was found that better record keeping was essential. The study also revealed that school districts employing school mechanics paid more for bus maintenance but this was almost compensated for in savings in gasoline, oil, and tires.

It was further revealed that Michigan school districts are finding the 1957 Amended Transportation Code generally satisfactory as an instrument governing the transportation of pupils and allocating funds for so doing.

Recommendations

1. That the Department of Public Instruction publish a handbook containing recommended pupil transportation practices.

2. That a study be made of the use of carefully selected, well trained student drivers as a means of reducing pupil transportation costs.
3. That a study be made of the possibility of effecting pupil transportation capital outlay savings by such means as the purchasing or leasing of school buses through a state or county governmental agency.
4. That a further study be made involving the effectiveness of school mechanics as opposed to private garages.
5. That county level studies be encouraged to promote better transportation policies and practices.

Microfilm \$3.65; Xerox \$12.85. 281 pages.

CERTAIN CHARACTERISTICS AND ACTIVITIES OF SCHOOL BOARD MEMBERS IN MISSOURI

(L. C. Card No. Mic 60-6829)

Donald Fount Wyss, Ed.D.
University of Missouri, 1960

Supervisor: James E. Hart

PURPOSE: The purpose of this study was to investigate certain characteristics of school board members, the agencies and reasons influencing members to become candidates for the board, and certain of their activities in becoming trained for their positions and in serving their schools.

METHOD OF RESEARCH: The methods of research used in the study were description and analysis. The primary data were obtained from information blanks returned by 289 school board members representing sixty-one schools which maintained high schools in Missouri. Chi-square and contingency tables were used to test relationships between characteristics and activities of the school board members.

SUMMARY:

1. The median age of school board members in this study was 44.3 years.
2. Four and one-half per cent of the school board members were women.
3. The median length of service on the school board was 4.1 years.
4. More of the school board members were farmers than any other occupational group.
5. About four-fifths of the board members had children in school.
6. Six and nine-tenths per cent of the board members had sent their child to a non-public school some time during his school career.
7. The median education completed by members in this study was twelve and four-tenths years.
8. The median income of board members in this study was between \$6,000 and \$8,000 per year.

9. More school board members reported they were influenced to become candidates for the board by other members on the board than were influenced by any other agency.
10. The major reason influencing board members to be candidates for the board was the desire to render civic duty.
11. In becoming orientated for their position more board members reported they conferred with other board members than reported they conferred with the superintendent of schools.
12. More school board members reported they read materials related to the financial affairs of the school than to any other subject.
13. Only about one-third of the board members reported they communicated with their state legislator and less than one-fifth reported they communicated with their congressmen.
14. More school board members from the larger schools reported they attended professional meetings, visited schools, and read widely than did members from the smaller schools.
15. More school board members from the larger schools reported they spoke to organizations in the community and communicated with their law-makers than did members from the smaller schools.

CONCLUSIONS:

1. School boards in Missouri tend to be self-perpetuating.
2. Most school board members are motivated by a multiplicity of reasons to become candidates for the board but the majority are oriented toward school improvement.
3. The stated reasons which board members give for service are not always related to the board member's activities.
4. School board members who have served on the board longer than one term tend to be more active in attempting to improve their schools than first term members.
5. School board members from the higher educational and income levels tend to be more active in training themselves for their positions than do members from lower levels of education and income.
6. School board members who attend meetings and read much tend to be more active in attempting to improve their schools than members who do not. Microfilm \$3.10; Xerox \$10.80. 239 pages.

A STUDY OF UNDERSTANDING LEVELS OF SELECTED FIFTH AND SIXTH GRADE ELEMENTARY PUPILS

(L. C. Card No. Mic 60-5264)

Marvin Herbert Yaffe, Ph.D.
The University of Connecticut, 1960

The purpose of this study was to investigate the ability of selected average and above average fifth and sixth

grade elementary pupils to work successfully with introductory algebraic skills and concepts which are generally taught in the ninth grade.

The result of the studies led to the examination of the following questions:

1. What are the criteria for choosing those pupils who can work with algebra successfully?
2. To what extent can fifth and sixth graders learn algebraic skills?

The criteria for selecting 141 fifth and sixth graders for the experimental group, and 128 fifth and sixth graders for the control group were based on the pupils meeting one of the following:

1. A minimum I.Q. score of 90 on the Lorge-Thorndike Non-Verbal Test.
2. A grade level score in total arithmetic skills, as measured by the Iowa Arithmetic Basic Skills Test.
3. A grade level score in reading comprehension on the Gates Reading Inventory for grades three to ten.

The procedure was as follows:

1. Two fifth and two sixth grade classes for one Thomaston, Connecticut school, and one fifth and one sixth grade class from another elementary school in Thomaston were the experimental group. This writer taught one fifth and one sixth grade class introductory algebra, which included writing equations, finding values of formulas, solving simple and combination equations, addition, subtraction, division and multiplication of signed and literal numbers. Four teachers, two fifth and two sixth grade instructors, taught the same exercises to their regular classes.

2. The algebra prognosis test was given to the experimental group only, since it is in part a teaching test; and the control group was not to have been exposed to algebra instruction. All other tests, including two algebra tests, were given to both groups.

3. The instructional period was twenty-two days for all pupils in the experimental group.

The analysis of data included tests of significance, and the simple and multiple correlation analysis.

Student's *t* results showed that the control and experimental groups were not significantly different in respect to the pre-tests. However, the experimental group presented algebra mean scores which were very significantly above those of the control group.

Simpler linear correlations indicated:

1. Mental age was most highly correlated with algebra prognosis results.
2. I.Q. was most highly correlated with the Final Unit Test totals.
3. The Iowa Arithmetic Basic Skills totals were highly correlated with Algebra Achievement Test and Final Unit Test totals.

The data were submitted to the Massachusetts Institute of Technology for calculation of Beta coefficients. The Beta coefficient determined the importance of each test in a given combination and also could be used to predict a student's success on the Final Unit Test. Multiple correlation coefficients were also calculated to determine the amount of correlation between the Final Unit Test and other tests.

I.Q., Gates Reading Inventory, and Iowa Arithmetic Basic total gave a multiple *r* of .69. The Beta weights were: .33 for I.Q.; .20 for Gates Reading Inventory; .34 for Iowa Arithmetic Basic total. This means that a

student's score on the Final Unit Test could be predicted by multiplying each of the tests in the combination by its Beta weight and then adding them all together.

The data in the thesis support the assertion that arithmetical ability, a high score on an intelligence test, and good reading comprehension tend to indicate the success a fifth or sixth grade student would have in the study of introductory algebra. However, since the multiple correlations were found to be less than .70, one needs to be cautious. There is less than twenty-five percent better-than-chance prediction with these correlations.

Some fifth and sixth graders can learn introductory algebra with profit; others cannot. Children who score low on arithmetic, I.Q., and reading tests would tend to score low on the Final Unit Test total. According to the Beta weights in one combination, arithmetic and reading are important. Microfilm \$2.75; Xerox \$6.00. 125 pages.

EDUCATION, ADULT

AN INVESTIGATION OF THE STATUS OF THE STUDENT PERSONNEL PROGRAM IN EVENING COLLEGES

(L. C. Card No. Mic 61-524)

John Simonaitis, Ed.D.
Syracuse University, 1960

This study was undertaken to determine practices and desirable provisions of the student personnel program in evening colleges and to examine their influences on enrollment. It was felt that it would make several valuable contributions to a better understanding of the status and the value of the student personnel program in evening colleges.

The questions it was particularly concerned with are:

1. What personnel provisions are currently provided and to what extent?
2. What provisions of those prescribed for the day college student are also considered appropriate for the evening college student?
3. Is there a difference in emphasis with respect to certain provisions in different types of evening colleges?
4. Is the drop-out rate (defined as students who fail to complete their courses, dropping out before the end of the term) related to the number of provisions in the personnel program?
5. Is the non-returnee rate (defined as students who fail to re-enroll for the immediately succeeding term) related to the number of provisions in the personnel program?
6. Do some major services have a greater relationship with the drop-out and non-returnee rate than do others?
7. Is there a difference in the drop-out and non-returnee rate between those colleges providing many personnel provisions and those colleges providing few personnel provisions?
8. Does the level of professional training possessed by the personnel director have any influence on the number of provisions provided in the personnel program and the extent to which they are carried out?

To obtain the answers to the above questions the following hypotheses were proposed and tested:

1. There is no significant divergence of the obtained responses to the statement, "this provision is essential in meeting the needs of adults" from the responses expected on the null hypothesis of equal probability.
2. There is no significant relationship between the total number of provisions in the personnel program and the number of drop-outs.
3. There is no significant relationship between the total number of provisions in the personnel program and the number of non-returnees.
4. There is no significant relationship between the drop-out and non-returnee rate and each major service of the personnel program.
5. There is no significant difference in the drop-out and non-returnee rate between colleges with many provisions and colleges with few provisions in the personnel program.
6. There is no significant difference between colleges having the most professionally trained personnel directors and colleges having the least professionally trained personnel directors with respect to the number of provisions in the personnel program and the extent to which they claim these provisions are carried out.

The data was collected by means of a twelve page printed questionnaire. It was mailed to 120 evening colleges throughout the country. One hundred questionnaires were returned. Eighty of them or 66 per cent were sufficiently complete to be included in the study.

The significant conclusions of the study are:

1. Most of the provisions considered essential in a personnel program for day college students are also considered essential provisions in a personnel program for evening college students. However, only 21 of 112 considered essential are carried out to a satisfactory extent by at least 50 per cent or more of the evening colleges.
2. The three types of colleges tend to agree on the provisions considered essential for adults.
3. There is no significant relationship between the number of provisions provided in the personnel program and the number of drop-outs.
4. There is a significant negative relationship between the number of provisions provided in the personnel program and the number of non-returnees.
5. There is no significant relationship between each major service of the personnel program and the number of drop-outs.
6. There is a marked negative relationship between Student Personnel Service 7 and the number of non-returnees and between Student Personnel Service 8 and the number of non-returnees.
7. When ranked according to the number of provisions provided and carried out, the upper 25 per cent of the colleges, when compared with the lower 25 per cent of the colleges, have a significantly lower rate of drop-outs and non-returnees.
8. When ranked according to the level of the personnel director's professional training, the upper 25 per cent of the colleges, with the most highly trained personnel director, when compared with the lower 25 per cent of the colleges, provide a greater number of provisions in the personnel program and carry them out to a greater extent.

Microfilm \$2.75; Xerox \$6.80. 142 pages.

EDUCATION, HISTORY

**A HISTORY OF THE DEVELOPMENT OF THE
CONCEPT OF CITIZENSHIP EDUCATION
IN AMERICA, 1900 TO 1950.**

(L. C. Card No. Mic 60-6975)

John Hardin Best, Ph.D.
The University of North Carolina, 1960

Supervisor: Samuel M. Holton

The purpose of this study was to trace the development of the concept of citizenship education in America from 1900 to 1950. From an analysis of the writings of educators in professional journals of education during the period, it was possible to document the changes and developments in thinking in the area. The study dealt with several aspects of citizenship education including the aims, definitions, psychology, method and curriculum in each of five chronological periods. The first period included the years from 1900 to 1914, the second the years of the First World War, the decade of the 1920's the third, the depression years of the 1930's the fourth, and finally the period of war and peace from 1940 to 1950.

The findings of the study indicated that during the period from 1900 to 1914 citizenship education was defined in a limited and narrow sense as essentially character education, with the objective of teaching personal ethics. Exponents of the existing faculty psychology appeared to endorse the direct teaching of morals through a method and curriculum of strenuous disciplining of the mind. During the First World War there was evidence of the effect of the wartime nationalism and patriotism, and also evidence of the rising influence of progressivism on the development of thinking concerning citizenship education. During the decade of the 1920's, the findings indicated the influence on citizenship education of such research projects as the Character Education Inquiry and the University of Iowa Institute of Character Research. The research of the period seemed to provide a sound psychological basis for revisions in the method and curriculum toward increased student participation and active problem solving in citizenship education. The aim and definition of citizenship education widely accepted during the period was the progressive view, "education for social competence."

The influence of the economic depression of the 1930's on the concept of citizenship education was directed toward a new emphasis on social responsibility. Educational writers saw citizenship education as a tool to be used in speeding the recovery of the economy, in the strengthening of democracy, and in view of some writers, in the building of a new social order. With the background of the new gestalt psychology, the emphasis in method appeared to be upon action and experimentation, and in the curriculum upon a broadened view which would include all of the activities of the school as well as much of the community.

The study of the period of war and peace of the 1940's pointed out several contrasts in the concept of citizenship education with the period including the First World War and the post war years, as well as certain comparisons with the period of national emergency of the depression of the 1930's. The findings indicated a continuation of the strong social emphasis in citizenship education with, however, an expansion in thinking to include a concern for

international problems and world peace. The theory of conceptualization in psychology was found to lead to the introduction of the unit or project method on an expanded scale in the teaching of concepts in citizenship during the 1940's.

The general finding of the study was that intellectual, social and political influences during the years from 1900 to 1950 led to changed views of the individual's relation to the society. In the development of the role of the school in society, citizenship education appeared to be considered an essential part of the augmented responsibility of the school to society.

Microfilm \$3.45; Xerox \$12.15. 266 pages.

**THE OLD ORDER AMISH VERSUS THE
COMPULSORY SCHOOL ATTENDANCE LAWS:
AN ANALYSIS OF THE CONFLICT.**

(L. C. Card No. Mic 60-6078)

Thomas Arthur Billings, Ph.D.
University of Oregon, 1961

Adviser: Keith Goldhammer

The Problem: The conflict discussed in this study arose as a result of the contentions of the Old Order Amish religious sect in protest against the legality and the wisdom of the Ohio compulsory attendance laws. The research dealt with the following questions:

- (1) What are the differences between the education provided in Ohio's public schools and that education provided in Amish parochial schools?
- (2) Was the intention of the compulsory attendance laws to modify all religious, social, ethnic, and racial customs and patterns to a common image and likeness? If this was not the intent, is it possible that this is an inadvertent effect?
- (3) Do the compulsory school attendance laws involve the state in a violation of basic liberties and rights of its citizens?
- (4) Are compulsory school attendance laws an expression of the will of the state or do they reflect only the will of the majority? If they reflect the will of the majority are minority groups powerless to resist?
- (5) Are there areas of parental jurisdiction with which governmental action may not interfere? If so, what are these areas?
- (6) Are the "rights" of religious minorities only those rights which majority opinion tolerates or defines as rights at any given moment? Or are there "rights of conscience" and "rights of action" which are not dependent upon the caprice of majority opinion, i.e., rights guaranteed by constitutional provision?

Research method: An adequate analysis of the conflict between the Amish contentions and the laws of the government of Ohio entailed several research methods, chief among which was the case study approach, requiring a residence in the State of Ohio for a time period sufficient to gather primary data. The research also required the analysis of numerous historical documents and court records concerning the development of the Old Order Amish and the sect's recurring conflict with civil power. Interviews with both school authorities and Amish spokesmen were undertaken in the collection of data.

The findings:

- (1) The conflict in Ohio, and elsewhere, between the Old Order Amish and the compulsory school attendance laws is not merely a legal problem, but a moral and ethical problem as well.
- (2) Many of the principles which underpin the American concept of free-government are being challenged by the action of the school officials in the Ohio conflict.
- (3) The treatment accorded Amish parents in the Ohio conflict would seem to offend against the spirit of the historic Supreme Court decisions of 1925 and 1944 which assured American citizens of "the right of the parents to direct the rearing and education of their children, free from any general power of the state to standardize children by forcing them to accept instruction from public teachers only."
- (4) The Ohio legislature is beginning a full-scale study of the Amish-school conflict and a re-evaluation of the compulsory attendance laws in Ohio.
- (5) The peculiar climate of the mid-twentieth century has given added interest (and perhaps urgency) to the conflict in Ohio. The Amish refusal to comply with the central tendency of the culture which prides itself on its "progress" has caused considerable re-evaluation of this "progress" even at the legislative level.
- (6) If minorities such as the Amish are to be secure in their "rights," a strong barrier of "moral conviction" must be built which would establish limits to man's natural tendency to impose his opinions and inclinations upon his neighbor, whether by legal sanction or social coercion.
- (7) The formal statements of position presented by the conflicting factions indicate a general distractedness and lack of communication. On at least one side in the dispute, there was obvious use of name-calling, innuendo, half-truths, and calumny.
- (8) The Amish contentions in the Ohio conflict seem to be encouraging an extensive and profound re-evaluation of key American values reflected in America's school systems, both public and parochial. The outcome of this re-evaluation will depend upon the degree of "civilization" which Americans have attained.

Microfilm \$2.75; Xerox \$9.25. 205 pages.

**THE PROBLEM OF RECONSTRUCTING
KOREAN EDUCATION IN
HISTORICAL PERSPECTIVE**

(L. C. Card No. Mic 61-103)

Sung Pyo Choi, Ph.D.
University of Illinois, 1960

The Republic of Korea (South Korea), upon its liberation, expressed a desire to guide its life in terms of democratic values, and so were also its educational objectives. However, despite such an ideal and the fact that Koreans generally value education very highly, the actual progress of the educational enterprise in Korea is as yet very little.

The primary factor that contributes to the retardation of the educational progress in the Republic is the impoverished economic situation of the country. That is, as the result of the zonal division of the land of Korea into two parts and the subsequent outbreak of the Korean War, the Republic was deprived of not only those natural resources which were lying abundant in the northern part of the country but the originally meagre economic resources of the Republic have been severely devastated by the war.

Besides such a physical factor, however, the more significant factor that also serves as a cause of the retardation of the educational progress in the Republic is that very few people in Korea understand the implication of the democratic way of life and its education. Thus, while democracy and democratic education are highly advocated by both the government and the people, practically, they leave much to be desired. Not only do educational activities not reflect the actual need of the country but there are profound discrepancies between what is taught at school and what is done in practical life.

Koreans' lack of democratic knowledge is however a natural consequence. That is, in the past, they have had no experience in democratic living; under the political system of monarchy and, at other times, colonialism, they were denied not only the opportunity of practicing self-government but also universal public education--two indispensable elements for the democratic way of life.

Besides the Koreans' lack of knowledge concerning the democratic way of life and its education, however, American educational advisors who are engaged in the undertaking of rebuilding Korean education are also responsible for the retardation of educational progress in the Republic. For, owing to their lack of knowledge concerning the educational as well as social situation of Korea, their advice and leadership often lack balanced emphasis and therefore tend to produce a somewhat ineffective result; consequently, the more important phase of education in the Republic is neglected. Thus, while more and more educational institutions are being built, and more and more people are in touch with some sort of education, not only the welfare of the Republic has not been improved but, on the contrary, the increase of educational institutions and the diffusion of education only parallels the gradually impoverishing economic life of the people and the increase of "idle intelligentsia."

From such a viewpoint of the educational proceedings in the Republic of Korea, and in an attempt to bring about more balanced effects in the democratization of education in the Republic, the present paper studies the social and intellectual foundations of Korean education throughout its history and then American education, also on its

foundations. Then as the result of the comparison of the educational situations of the two countries, the following proposals are made as the most important items for consideration in the transitional period of Korean education: Emphasis upon "Fundamental Education," Orientation as to the conception of Vocational Education, and Significance of Teacher Education.

Microfilm \$4.50; Xerox \$15.75. 350 pages.

RELIGIOUS PRACTICES IN THE PUBLIC SCHOOLS IN SELECTED COMMUNITIES IN KENTUCKY

(L. C. Card No. Mic 61-295)

Jack Jones Early, Ed.D.
University of Kentucky, 1956

Director: Dr. Ellis F. Hartford

Statement of the Problem

This is a study of the religious practices in the public schools in selected communities in Kentucky. It was felt that since many religious leaders have sought to re-examine public school policies in relation to religious education there is a need for a clearer understanding of the present religious practices in the public schools.

The Procedure

The study is limited to five selected communities representing different positions on a rural-urban continuum of Kentucky counties. The communities were: Harrison, Simpson, McLean, Johnson, and Adair.

The interviewees were limited to twenty-five per cent of the public school teachers in each of the communities. One hundred and thirty-two interviews were conducted.

The Findings

The study revealed the following religious practices in the public schools in the five selected communities:

(1) A majority of the teachers indicated that it was the policy of the schools to permit the distribution of Bibles or other religious materials.

(2) A majority of the teachers indicated that there were religious pictures, symbols and mottos displayed in their respective schools.

(3) There were student religious organizations connected with the public schools. Some of these organizations met off the school campus during regular school hours and others met in the public school buildings during regular school hours.

(4) A majority of the teachers indicated that they encouraged and checked on the Sunday school and church attendance of their students.

(5) The teachers indicated that Christmas and Thanksgiving were the primary religious festivals observed in the public schools.

(6) The secondary teachers indicated that the public schools usually invited ministers to speak in the chapel and assembly programs; also, that the public schools usually had a baccalaureate service in connection with commencement.

(7) A majority of the teachers indicated that they followed the legal ruling on Bible reading in Kentucky. However, a number of the teachers indicated that they "commented on" the Bible.

(8) The teachers in Harrison county indicated that a "few" parochial school children were transported on public school vehicles and that the cost was paid by the fiscal court.

(9) A majority of the teachers indicated that prayers and hymns were used in the public schools.

Conclusions

The findings of this study, evaluated in terms of constitutional, historical, educational and sociological criteria, tended to support the hypothesis that the public schools have already assumed a greater responsibility with reference to religious practices than can be justified from the standpoint of the meaning of the principle of separation of church and state.

The second hypothesis, that religious practices in the public schools will be more frequent and greater in number in the homogeneous communities than in the heterogeneous communities, does not seem to be supported by the findings of this study. However, the study revealed there were some significant differences between the religious practices in the public schools in the rural and the urban communities.

Implications for Teacher Education

The study may be helpful in assisting teacher training institutions in developing educational policies with reference to the present relationship of public education and religion.

The teacher training institutions should provide experiences for student teachers dealing with the meaning of the principle of separation of church and state, a more comprehensive understanding of different religions, and a study of methods in handling subject matter in regular courses which may be controversial from the standpoint of religion.

The public schools should be more concerned with the development of moral and spiritual values among the students and less concerned with the teaching of sectarian religion. Microfilm \$3.05; Xerox \$10.60. 235 pages.

THE HISTORICAL DEVELOPMENT OF ELEMENTARY SCHOOL FUNCTIONS IN AMERICA

(L. C. Card No. Mic 60-6079)

Raymond Joseph Endres, Ph.D.
University of Oregon, 1961

Adviser: Paul E. Kambly

In 350 years American elementary schools have undergone a remarkable metamorphosis. As America developed a complex industrial and urban society, the school's functions became more numerous. Some functions were introduced, became dominant, and subsequently waned in importance.

A critical study of elementary school functions required historical analysis. Two purposes of this study were:

(1) to present an accurate account of the functions fulfilled by elementary schools from colonial times to the present; and (2) to analyze the historical data leading to generalizations that would serve as guides to present and future considerations of the functions of the elementary school.

Fulfillment of the study's first purpose required two phases: (1) the history of elementary school functions from 1607 to 1950; and (2) an historical analysis of four 20th century philosophical movements in education and the functions prescribed for the school by each.

The second purpose was fulfilled in three phases: (1) identification of points of agreement about school functions among philosophers, critics, and curriculum authorities; (2) identification of issues arising from basic disagreement about school functions; and (3) enumeration of implications for educators working in the nation's elementary schools.

In each of four historical periods a particular function was primary. The religious function dominated the colonial period (1607-1775); the individual learned to read in order to participate more effectively in ecclesiastical institutions. The political function dominated the national period between 1775 and 1875; the individual required schooling in order to participate more effectively in political agencies. Between 1875 and 1929, a period of rugged individualism, the school provided the individual with the education needed to achieve economic and social success; at the same time it helped assimilate the foreign born. From 1935 to 1955 the school's social function predominated; the pupil was led to evaluate social problems and to participate in the identification of cultural values.

The elementary school always fulfilled four functions: (1) transmission of the cultural heritage; (2) adjustment of the individual to prevailing social norms; (3) instruction in communication and quantification; and (4) development of habits and attitudes leading towards self-discipline and responsible citizenship.

The study identifies the functions prescribed for the school by each of four 20th century philosophical movements in education: (1) progressives thought the school should provide a learning environment in which children had experiences and reflected upon them in solving socially significant problems; (2) essentialists believed that the school transmitted the cultural heritage and instructed children in communication and computation; (3) reconstructionists claimed that the school should lead children towards commitment to socially oriented values; and (4) academicians wanted the school to instruct the child in the fundamental disciplines.

Philosophers, critics, and curriculum authorities generally agreed that the school (1) is responsible for only a part of the child's formal education; (2) insures the continuance of the cultural heritage; (3) serves both the individual and society; (4) provides certain, limited service functions; (5) provides a transition from informal to formal educational experiences; (6) instructs in the fundamental communication and number skills; (7) shares character development with other agencies; (8) is not responsible for adjusting children to prevailing social norms; (9) is not a corrective agency; (10) is not expected to provide the type of educational facilities needed to care for extreme mentally disabled children.

Several pertinent issues concerning elementary school functions included: (1) Do functions change or remain static? (2) Is the school's responsibility towards individual

value development direct or indirect? (3) Do public and parochial schools work at cross purposes? (4) Should the school provide common experiences or differentiated ones? (5) Should the school instruct in foreign languages?

The study suggested several implications for educators involved in elementary school work. Education is a totality of which schooling is a part. Informal education is provided through incidental experience; formal education is provided by social institutions--family, church, community, and school. Educators must continue to evaluate the school's task as a part of the total educational superstructure of the culture. Educators should ask themselves three questions before adding to the school's responsibilities: (1) Does the addition contribute to the fulfillment of generally accepted functions? (2) Can something be removed to make room for the addition? (3) Can the added function be better fulfilled by another social agency?

Microfilm \$2.75; Xerox \$8.80. 191 pages.

AN HISTORICAL STUDY OF THE
PENNSYLVANIA SCHOOL JOURNAL
WITH REFERENCE TO THE ENACTMENT
OF EDUCATIONAL LEGISLATION,
1852 TO 1952.

(L. C. Card No. Mic 61-43)

Royce Oliver Johnson, Ed.D.
The Pennsylvania State University, 1960

Purpose

The purpose of this study was to review the history of the Pennsylvania School Journal with reference to the enactment of educational legislation during the century from 1852 to 1952.

Procedures

A jury was selected to choose one educational achievement that was enacted into law in each twenty-year period of the years from 1852 to 1952 which seemed most important to educational progress in Pennsylvania. The following legislative milestones were selected by the jury and were in their judgment so important that the Pennsylvania School Journal might well have supported or opposed them actively:

- 1857 Provision was made for the establishment of normal schools.
- 1873 The legislature shall provide for the maintenance and support of a universal public school system in every district of the state.
- 1895 The first compulsory attendance law was passed.
- 1921 The Edmonds Act which provided state reimbursement contingent upon the maintenance of certain standards was made effective.
- 1937 The teacher tenure act was passed.

In order to find out whether or not the Pennsylvania School Journal had actually been active in the campaigns for or against the enactment of educational legislation,

study was made of the achievements selected by the jury. This was accomplished (1) by reviewing the back issues of the Pennsylvania School Journal for the five-year period previous to the passage of each act; (2) by study of the files of certain newspapers for the periods of the several legislative sessions; and (3) by searching the records of the proceedings of the Pennsylvania State Legislature and the Constitutional Convention of 1873 for the respective sessions.

Conclusions

1. The Pennsylvania School Journal was used extensively to keep the subscribers informed regarding the goals and objectives of the state teachers association and to stimulate and direct the activities of those in positions of professional leadership.

2. Newspapers made little reference by direct quotation to articles or positions taken by the Pennsylvania School Journal during the campaigns for the legislation studied.

3. Little evidence of direct quotation by members of the legislature or the Constitutional Convention of 1873 was found. Some indication that the Pennsylvania School Journal was read may be inferred by the fact that members of the legislature in several sessions used expressions, quoted information, and reflected attitudes that the Pennsylvania School Journal had attempted to promote.

4. The long-range development of readiness for legislation was revealed as an important function of the Pennsylvania School Journal.

Recommendations

1. The long-range development of readiness for legislation should be recognized as a major function of the Pennsylvania School Journal. Continuing studies should be made to determine what those objectives should be, and careful effort should be made to keep them consistently at the attention of members of the state teachers association.

2. Greatly increased use of newspapers should be made to enlist support for educational goals. Efforts should be made, possibly through the local branch reporters to newspapers, to have carefully selected articles copied in the public press.

3. Provision should be made for the editor to speak editorially in a personal way to the members of the association and for a department wherein the voice of the membership may be heard.

4. Studies should be made to find ways to overcome the inertia of members who are not in positions of leadership during legislative sessions.

Microfilm \$2.75; Xerox \$7.80. 166 pages.

RICHARD FURMAN AS A LEADER IN BAPTIST HIGHER EDUCATION

(L. C. Card No. Mic 60-5865)

Howard McConneral Kinlaw, Ph.D.
George Peabody College for Teachers, 1960

Major Professor: Dr. William C. Jones

The purpose of this study was to examine the contributions of Richard Furman to the early development of Baptist higher education in the South, and to apply his educational philosophy to present trends in Baptist Christian education.

Recently, the Furman family presented to the Baptist Historical Collection, Furman University Library, Greenville, South Carolina, a great wealth of primary source material that, hitherto, had not been released. This material consists of original documents and personal correspondence pertaining to the life and works of Richard Furman, and sheds additional light on the struggles and aspirations experienced by himself and those with whom he was immediately associated in the cause of Baptist higher education. The writer has, also, made use of the original minutes of Baptist organizations, and of related secondary sources.

Findings of the Study

Baptist educational beginnings in the South center around one small church, one dominant personality, and a particular geographic location. The story begins in 1754, when Oliver Hart, pastor of the only Baptist church of Charles Town in the colony of South Carolina, organized the Religious Society for educational purposes. It was a sort of evening school held in the homes of his parishioners, and was not very successful. The movement was more fully developed when Richard Furman, Oliver Hart's successor, created the General Committee of the Charleston Baptist Association in 1791.

This committee was the only educational organization in existence among Baptists of the South until the denomination formed a national body in 1814 and, soon thereafter, established Columbian College (now George Washington University) in the nation's capital. The institution was a part of Richard Furman's plan of education, which included the establishment of auxiliary schools, strategically located, to educate the Baptist constituency of America.

Adequate motivation was provided by the woeful ignorance of the masses and the need to train civic leaders in the perpetuation of their newly won civil and religious liberty.

In 1821 Richard Furman began a movement to establish one of the auxiliary schools in South Carolina which eventuated in the founding of Furman University in 1826. At least four similar auxiliary schools were opened in other parts of the country.

Furman died in 1825 and his plan for a national system of education, centered in Washington, did not materialize. Instead, the Baptist State Conventions developed a system of independent state colleges and universities, each academically self-sufficient. The educational philosophy of Richard Furman, however, has endured the test of time and change, and continues to exert a strong influence on Baptist Christian education as it exists today.

One can only conjecture which of the two plans would have produced the better educational system to serve the national interest, and promote unity and fellowship among the people they represent.

Microfilm \$2.95; Xerox \$10.35. 228 pages.

SOME ASPECTS OF BIRACIAL PUBLIC EDUCATION IN GEORGIA, 1900-1954.

(L. C. Card No. Mic 60-5867)

Leland Clovis Thomas, Ed.D.

George Peabody College for Teachers, 1960

Major Professor: Bennie Carmichael

The Purpose of the Study

The purpose of this study is to compare and contrast the development of white and Negro public elementary and high schools of Georgia from 1900 to the date of the United States Supreme Court decision regarding segregation in the public schools, May 17, 1954.

The Method of the Study

In analyzing the many studies, investigations, and reports found during research, the historical method was used.

Summary

The development of biracial public education in Georgia is considered in five chapters:

- I. The Beginning of Tax Supported Education on the Local Level in Georgia, 1900-1916
- II. The Struggle for Education from War Through Depression, 1916-1937
- III. Biracial Education Under the Seven Months School Law, 1937-1949
- IV. The Minimum Foundation Program Achieved, 1949-1954
- V. Summary

Biracial education refers to those schools provided for the separate races, white and Negro. Schools were considered public schools if they were aided financially by the state.

Georgia crusaders for better education worked for legislation to make it possible for communities to tax themselves for school purposes. The McMichael Law of 1904 and its amendments provided for taxation up to five mills.

In 1911, an amendment was ratified which authorized state support for a "thorough system of common schools," thus overcoming the Constitutional obstacle to public high schools.

The first compulsory attendance law in Georgia in 1916 proved to be a significant step in combating illiteracy in both races.

Because some counties refused to tax themselves, the Elders-Carswell Amendment was passed requiring each county to levy from one to five mills for education and permitting taxation of another five mills.

The Barrett-Rogers Act in 1919 provided funds to aid consolidated elementary schools and four year high schools. The Carswell Act in 1920 increased consolidation by additional appropriations for high schools.

In an attempt to equalize educational opportunities, an act in 1926 provided extra opportunities for the poorer counties.

The turning point in public education in Georgia came in 1937 with the passage of the Seven Months School Law which was a more effective equalization measure because it gave greater benefits to the most sparsely populated counties. This law and the Free Textbook Law of 1937 definitely placed the major burden of school financial support upon the state.

Following World War II, in 1945, a new constitution was adopted. Changes concerning education were made, some of them being the abolition of conflicting statements and antiquated provisions. The Constitution further emphasized the responsibility of the state to provide an adequate education for its citizens.

The greatest step in reducing inequities in biracial education in Georgia came from 1949 to 1954 with the initiation of the Minimum Foundation Program of Education and the State School Building Authority.

Conclusions

Free public education is legal by provision of the Georgia Constitutions, 1877 and 1945. Both provide for separate schools for the races.

At first, the separate systems in Georgia were financially supported by private philanthropy, missionary enterprise, or governments. Initially, the Negroes received greater support from private philanthropy and missionary enterprises and the whites received support from governments.

No differential based on race now exists in disbursement of funds from the state level. In the dual systems, expenditures per capita generally vary according to the percentage of each race in the system.

Inequities in educational opportunities existed and still exist; however, most people in Georgia have shown a willingness to promote education for equality of opportunity but maintain that though education be equal it must be separate.

Microfilm \$2.75; Xerox \$9.00. 199 pages.

A STUDY OF N. K. KRUPSKAYA'S EDUCATIONAL PHILOSOPHY.

(L. C. Card No. Mic 60-6831)

John Thomas Zepper, Ed.D.

University of Missouri, 1960

Supervisor: Dr. Lloyd P. Jorgenson

PURPOSE: The purpose of this study was to translate portions of the writings of Nadezhda Konstantinovna Krupskaya, Lenin's wife, and to describe certain aspects of her educational philosophy. Three aspects of her work were investigated: (1) her position and writings as an educational historian and theorist, (2) her writings on polytechnical education, and (3) her writings on the "complex."

METHOD OF RESEARCH: Library research was used to gather data related to Krupskaya's work. Original translations were made by the investigator to supply the data for the study of Krupskaya's educational philosophy. Preceding the description of each aspect of Krupskaya's philosophy, related research and writings of other educators were presented.

SUMMARY: Nadezhda Konstantinovna Krupskaya was born in St. Petersburg on February 23, 1869. She became a Marxist while attending the St. Petersburg Higher Courses for Women. Lenin and Krupskaya were married in exile at Shusenskoe, Siberia. From 1900 to 1917, both in Russia and while in exile, Lenin and his wife-secretary engaged in socialist agitation and revolutionary activities. Krupskaya was active in all phases of Soviet education from 1917 to her death in 1939. Throughout her lifetime, she held many important educational and Party positions of leadership.

Krupskaya helped develop the communist method of studying the history of education. Her pamphlet, Public Education and Democracy, was written before 1917. It contains examples which support Krupskaya's thesis that production must be combined with education in order to develop a mass labor school. Communist interpretations of Western educational philosophers and methods comprise the content of this pamphlet.

Polytechnical education was advocated by Lenin and Krupskaya. Her Theses of 1920 started the Soviet schools on the road to polytechnism, but the Central Committee's decrees between 1931 and 1939 abolished this form of education. They also abolished the complex form of instruction. Krupskaya described the complex system and advocated its adoption on the elementary level. The themes of Nature, Labor, and Society were to be combined with a method of instruction to create fighters and builders of communism.

CONCLUSIONS:

- (1) Krupskaya was the most important Soviet pedagogue from 1920 to 1932. Since 1952, the educational writings of Krupskaya have been reemphasized in Soviet educational discussions.
- (2) Public Education and Democracy was, and still is, the basic Marxist-Leninist interpretation of Western education from the beginning of the eighteenth century until 1915. Krupskaya developed her fundamental philosophy of education through research for this pamphlet and became acquainted with many American Progressive educators and with the practices of vocational education.
- (3) Krupskaya was a "progressive" but a moderate one, because she advocated an activity curriculum and functional skills which maintained a balance between theory and practice.
- (4) Polytechnical education was a social and economic necessity in the Unified Labor School. It com-

bined participation in production with school studies so as to: (a) broaden the horizon of a student in relation to his environment, (b) develop an understanding of the planned Soviet economy and each student's part in this plan, and (c) nurture genuine communist attitudes toward labor and society.

- (5) Krupskaya believed in field trips, individual differences, motivation, grading, the functional aspect of the fundamental skills, and the use of maturational interests and needs of children in planning educational activities.
- (6) She maintained that fundamental skills could be taught efficiently in complexes. For Krupskaya, the complex was an integration of organization and method. Method was the most important element in this system, because of its role in instilling socialist habits.
- (7) Krupskaya was not a formal philosopher, but all aspects of her philosophy were interrelated because there was a unifying theme--the labor activities of mankind.

Microfilm \$3.85; Xerox \$13.50. 300 pages.

EDUCATION, PHYSICAL

THE EFFECT OF VARIED WEIGHT TRAINING PROGRAMS ON STRENGTH AND ENDURANCE

(L. C. Card No. Mic 61-84)

Richard Anthony Berger, Ph.D.
University of Illinois, 1960

The general problem in the present study was to determine whether strength would develop faster with fewer repetitions and heavier loads or with more repetitions and lighter loads and whether fewer or more sets were better. Associated problems were to determine whether there was an optimum combination of sets and repetitions for increasing strength most rapidly and whether this optimum might differ from the optimum combination for developing endurance. The subjects were one hundred and seventy-seven freshmen and sophomore male students in nine weight lifting classes at the University of Illinois. Each class trained on Monday, Wednesday and Friday for twelve weeks on the bench press lift with a different combination of sets and repetitions. The maximum strength of each subject on the bench press exercise was determined at the beginning and at three, six, nine, and twelve weeks of training. Endurance was determined before and after twelve weeks of training. Each subject employed one-half his maximum bench press lift and performed as many repetitions as possible at the rate of one repetition every two seconds.

Conclusions

1. With progressive resistance exercise involving all possible combinations of one, two, and three sets and two, six, and ten repetitions per set, strength improved significantly after three weeks of training and continued to improve significantly from three to six weeks, six to nine weeks, and nine to twelve weeks.
2. The groups reacted homogeneously to a wide variety of progressive resistance exercise programs.
3. Training with all combinations of one, two, and three sets and two, six, and ten repetitions resulted in different rates of strength improvement which differed more as training continued.
4. Training with three sets each session produced a greater improvement in strength than training with one or two sets at 6, 9, and 12 weeks of training. One set appeared just as effective in improving strength as two sets.
5. Progressive resistance exercise with six repetitions per set improved strength more than training with two repetitions per set at 9 and 12 weeks of training. After nine weeks of training, ten repetitions per set resulted in greater strength improvement than training with two repetitions. But after twelve weeks of training, two repetitions per set was as effective as training with ten repetitions per set.
6. Training with one, two or three sets in discrete combination with two, six, or ten repetitions per set (interaction) was not systematically more effective in improving strength than other combinations.
7. Strength did not improve consistently faster when heavier loads were employed for few repetitions (2-RM) or when lighter loads were employed for higher repetitions (10-RM). The optimum number of repetitions per set for improving strength was somewhere between the two extremes.
8. Endurance as measured (rhythmic repetitions at one-half the maximum lift) showed that seven groups decreased from .1 to 2.6 mean repetitions and two groups increased .4 and 1.3 mean repetitions after 12 weeks training. Since all groups improved significantly in strength, and consequently load per repetition, but differences in strength gains were significantly different between groups, comparison on the basis of simply repetitions was invalid.
9. In terms of work (repetition-pounds), all groups improved significantly at the one per cent level after twelve weeks training, so strength training increased endurance.
10. The number of sets used in training had little differential effect on the repetition-pounds since the groups trained with two sets had adjusted mean repetition-pounds of 2001.19, those trained with one set had 1969.69, and those using three sets had 1965.95.
11. Groups trained with ten repetitions per set showed greater improvement with a final adjusted mean repetition pounds of 2063.80, than those trained with six repetitions (1912.43) and two repetitions (1960.59).
12. The *F* for interaction in the endurance results was not significant so one, two, or three sets were not systematically better in combination with two, six, or ten repetitions.

Microfilm \$2.75; Xerox \$4.60. 87 pages.

CRITICAL INCIDENTS OF INSTRUCTIONAL METHODS IN PHYSICAL EDUCATION IN SOUTHERN SECONDARY SCHOOLS

(L. C. Card No. Mic 60-6642)

Marilyn Crawford, Ed.D.
The University of Texas, 1960

Supervisor: Dr. David K. Brace

The Problem: The general purpose of the study was to gain information relative to practices of good and poor teaching methods in southern secondary schools in a form which might have value for professional programs of physical education. The specific purposes were to develop a list of standards of good teaching methods in physical education as approved in the literature by educational authorities, to collect incidents of teaching methods used by high school teachers and coaches, to evaluate the incidents of teaching behaviors by the list of standards, and to investigate the relationship of certain external factors with the use of good and poor teaching methods.

The Procedure: Critical incident report blanks which had been prepared for this study were mailed in accordance with a sampling procedure to freshmen college students, teachers, and administrators who resided in the thirteen states as defined by the Southern District of the American Association for Health, Physical Education and Recreation. Respondents were requested to describe observed incidents of good or poor teaching methods used by high school teachers and coaches, and to answer several questions relative to themselves, the teachers reported in the incidents, and the situations in which the incidents occurred.

A total of 2,396 usable incidents were received from 556 students and 144 teachers and administrators. The incidents were categorized into sixty-five groups of homogeneous actions, arranged under twelve areas of teaching methods.

The Findings: The student respondents reported approximately the same types of incidents as did the teachers and administrators. The respondents agreed with the derived standards of good teaching methods in physical education by differentiating between good and poor methods.

The poor instructional methods reported most frequently related to teachers being absent from their classes, giving insufficient instruction, and using undesirable behaviors. The incidents of good teaching methods reported most frequently related to the use of student leaders, conducting and organizing practices well, and giving demonstrations well.

Relative to the proportion in which the different variables were reported, statistically significant findings at the .05 level or smaller revealed that good teaching methods were reported as being used more frequently: by women than by men, by teachers who were well-liked by students and other teachers than by teachers who were not well-liked, by teachers in the 25-40 age group rather than teachers of other age groups, and by teachers with Master degrees than by teachers with Bachelor degrees. In general, the study revealed no significant relationship between good and poor teaching methods and: the size of the schools or the size of the classes in which the incidents

occurred, the places in which the incidents occurred (gymnasiums or other locations), or the situations in which the incidents occurred (physical education classes or other part of the program).

Microfilm \$3.10; Xerox \$10.80. 238 pages.

STANDARDS FOR FACILITIES FOR PHYSICAL EDUCATION IN SENIOR HIGH SCHOOLS

(L. C. Card No. Mic 60-6643)

James Marshall Hughes, Ed.D.
The University of Texas, 1960

Supervisor: Dr. Lynn W. McCraw

Purpose. The primary purpose of the study was to formulate minimum standards for facilities for physical education programs in senior high schools. A secondary purpose was to evaluate facilities in twenty selected high schools in Central Texas.

Procedure. Tentative standards were formulated on the basis of an examination of the literature and from conferences with authorities in the field. In order to relate the standards to the typical school situation, specific information was obtained concerning the physical education programs and facilities in twenty selected high schools. Data were obtained by personal observations and conferences with teachers of physical education at these schools. The tentative standards were revised on the basis of the following criteria:

1. Standards were retained as originally stated when the presence or lack of facilities in the schools indicated that programs would be seriously handicapped when such standards are not met.
2. Standards were changed if it were found that the facilities recommended by such standards are not essential for the program.
3. Standards were revised or added where facilities not contained in the original standards were found to exist in certain schools and were considered desirable for the program.

The facilities that were found to exist in the twenty schools were evaluated in terms of these revised standards. The facilities at the schools were also evaluated on the basis of the extent to which they could provide for an adequate program of physical education as recommended by the Texas Education Agency Study Commission. Further, an analysis was made to determine the extent to which the schools utilized their existing facilities to offer programs as recommended by the Texas Education Agency.

Findings. In general, the tentative standards as developed from the recommendations of authorities were found to be applicable and essential in a practical situation for an adequate program of physical education. The revisions and additions to the tentative standards were primarily concerned with the clarification of detailed requirements, providing for multiple-use facilities, and relating the facilities to climatic conditions peculiar to the South. The schools meeting these revised standards should have

no difficulty in providing a program of activities as recommended by the Texas Education Agency Study Commission.

It is quite evident that the facilities in the twenty schools that were visited in the study are not adequate in terms of the standards that have been developed. Further, it is clear that these schools, in general, do not make maximum use of existing facilities. In so many instances, no attempt is made to offer instruction in various activities even though facilities for these are available.

It is believed that the standards that have been developed should be helpful to architects, administrators, physical educators, and others in the planning and construction of facilities for physical education and athletic programs. Further, the use of these standards in evaluating existing facilities should reveal inadequacies that need to be corrected in order to provide a well rounded program in physical education. The immediate task facing personnel in the profession is to make maximum utilization of existing facilities.

Microfilm \$3.70; Xerox \$13.05. 287 pages.

A STUDY OF EXTRA DUTY COMPENSATION FOR TEACHERS IN CERTAIN SMALL, MEDIUM, AND LARGE PUBLIC SENIOR HIGH SCHOOLS IN THE EASTERN DISTRICT OF THE AMERICAN ASSOCIATION FOR HEALTH, PHYSICAL EDUCATION AND RECREATION.

(L. C. Card No. Mic 61-527)

Ronald L. Van Ryswyk, Ed.D.
Syracuse University, 1960

Purposes

This study was concerned with determining the current administrative policies and practices regarding extra duty compensation in operation in the public senior high schools of the northeastern United States. Eleven states and the District of Columbia comprise this region which is the Eastern District of the American Association for Health, Physical Education and Recreation. An attempt was also made to determine the extent of any differences in current practices of small, medium, and large schools.

Procedures

All of the public senior high schools in the Eastern District for which discrete enrollment figures were available, i.e., 1,700 (of the approximately 2,100 such schools), were ranked by enrollment from smallest to largest. Sixty percent, or 1,020, were sampled in three size groupings of 340 each. Twenty percent selected from the lower portion of the range were designated as small schools, 20 percent from the middle portion of the range were considered as medium-size schools, and 20 percent from the upper portion of the range were designated as large schools.

A questionnaire was sent to the chief school administrator of each of these 1,020 schools. Replies were received from 888 addressees for a return of 87 percent.

Findings are presented in descriptive terms and in tables. The significance of these data was tested by the chi square technique.

Findings

Schools followed one of four possible policies of compensating teachers for extra duties. The policy of "no extra duty recognized, load compensation permitted," was followed by 12 percent of all schools and was less frequently used in medium-size schools. The policy of "including extra pay in the basic contract salary" was followed by 16 percent of all schools, with small schools most frequently employing it. "Adding extra pay to the basic salary" was the most frequently used of the four policies, with all three size schools favoring it in a frequency proportion of 60 percent. The policy of "no pay or load differential for extra duties" was used in 12 percent of the schools, this practice being most often used by small schools.

In cases where one of these policies was followed despite the fact that chief school administrators preferred a different one, the total of preferences was for "adding extra pay" in 52 percent of the cases, "including extra pay in the basic salary" in 32 percent of the cases, "not recognizing extra duty but permitting load compensation" in 12 percent of the cases, and "no extra pay provisions" in 4 percent of the cases. Satisfaction with policies currently employed was expressed by chief school administrators in the same order with 87, 71, 67, and 46 percent, respectively.

Board of education funds were the source in 95 percent of the cases that extra pay was assigned. Two hundred seventeen activities were listed as being assigned extra pay in a frequency total of 8,014 cases. Four category groupings indicated that extra pay was granted in the following proportions: interscholastic athletics 66 percent, club activities 20 percent, miscellaneous activities 11 percent, and intramurals 3 percent. As school enrollment size increased, so did the number of activities for which extra pay was assigned as well as the amounts of pay.

The chi square test indicated that these and other differences were significant in the sample in all except one of the twenty statistical comparisons.

A request for a copy of written policy guides on extra duty compensation resulted in 169 copies received from the 888 schools, i.e., 7 from small, 59 from medium, and 103 from large schools.

Microfilm \$2.75; Xerox \$7.80. 168 pages.

EDUCATION, PSYCHOLOGY

INTERFERENCE AS A FUNCTION OF CERTAIN FACTORS IN LEARNING TWO FOREIGN LANGUAGES CONTIGUOUSLY

(L. C. Card No. Mic 60-6044)

Hamad D. Al-Karbouli, Ed.D.
Indiana University, 1960

Chairman: Nicholas A. Fattu

This study involves an experimental examination of the role of interference in language learning. Ninety high school students were used in the experiment.

The problem of this investigation was twofold. Part I studied the effect of varying the teacher, the material and the mode of presentation at two levels each. Comparisons were made between the initial learning (Arabic) and the interpolated learning (Persian) in reducing the effect of retroactive interference.

The specific inquiries made in Part I were directed toward finding out (a) if there was a significant difference in the number of initial words recalled by the groups in which the initial and the interpolated learning were taught by the same teacher and the number recalled by the groups in which the initial material was taught by one teacher and the interpolated by another teacher; (b) if there was a significant difference in the number of the initial words recalled by the groups in which the initial learning was taught with one set of material and the interpolated was taught with another set; (c) if there was a significant difference in the number of initial words recalled by the groups in which the initial and the interpolated material were both presented through pictures and the number recalled by the groups in which the initial material was presented through pictures and the interpolated was presented through sentences.

Part II of this study was directed toward finding out if there was a significant difference in the number of initial words recalled by the control group, in which no learning took place in the period between the mastery of the initial learning and the test for its recall, and the number recalled by the following groups in which interpolated material was taught in the interval between learning the initial material and the test for its recall:

1. The first group, in which the three variables being investigated were identical in both the initial and the interpolated task.
2. The second group, in which only the mode of presentation was varied between the initial and the interpolated languages.
3. The third group, in which only the teacher was varied between the initial and the interpolated learning.
4. The fourth group, in which both the teacher and the mode of presentation were varied between the initial and the interpolated languages.
5. The fifth group, in which only the material was varied between the initial and the interpolated languages; that is, the groups in which the subject during the interpolated learning learned Persian by use of material which was different from that by which he learned Arabic.
6. The sixth group, in which the material and the mode of presentation were varied between the two languages.

7. The seventh group, in which the material and the teacher were varied between the two tasks.

8. The eighth group, in which all the three variables, material, teacher and mode of presentation were varied between the initial and the interpolated languages.

From the findings of the study it may be concluded that:

(1) Groups in which the initial material was taught by one teacher and the interpolated was taught by another recalled the initial material significantly better than the groups to which both the initial and the interpolated material were taught by the same teacher. (2) Groups in which the material was varied between the initial and the interpolated learning recalled better than the groups in which the same material was used for both initial and interpolated learning. (3) The difference in the words recalled of the initial learning was not significant between the groups in which the initial and the interpolated material was presented through pictures and the groups in which the initial material was presented through pictures and the interpolated material through sentences.

It is also concluded that when the control group was compared with each of the eight experimental groups the recall of the initial material by the control group was significantly better than the following groups: (1) The group, in which the variables being investigated were identical in both the initial and the interpolated languages. (2) The group, in which only the mode of presentation was varied between the initial and the interpolated languages. (3) The group in which only the teacher was varied between the initial and the interpolated learning. (4) The group, in which both the teacher and the mode of presentation were varied between the initial and the interpolated languages. (5) The group, in which only the material was varied between the initial and the interpolated languages. (6) The group, in which both the material and the mode of presentation were varied between the two languages. (7) The group, in which both the material and the teacher were varied between the two languages.

There was no significant difference in the recall between the control group and the group, in which the three variables being investigated (the teacher, the material, and the mode of presentation) were varied between the two languages. Microfilm \$2.75; Xerox \$4.60. 90 pages.

COMPARISON OF A CORRELATIONAL WITH A PROBABILISTIC APPROACH TO CONCEPT LEARNING

(L. C. Card No. Mic 61-81)

Hiroshi Azuma, Ph.D.
University of Illinois, 1960

The experimental methods commonly used in laboratory studies of concept formation employ binary cues and binary response alternatives. It is impossible to detect the emergence of a higher order cue which is a combination of information from more than one cue.

As an experimental method for the study of concept formation from multiple partially valid cues, the use of metrically multi-valued partially valid cues and metrically multi-valued response alternatives was proposed. Inference about the cue and the composite of cues which were

relied upon by a subject could be made by analyzing correlational relationships between the cues and his response.

A set of three working hypotheses were developed concerning the choice of the cues by the subjects. They were: (1) A cue which is correlated with the criterion by being a term of the formula which defines the criterion is learned even if the probability that this cue alone leads to the right answer was small. (2) The cue which has the highest validity is the one to which subjects respond. (3) Only under the condition which is designed in such a way that the validity of a composite cue is higher than the validity of any single cue, will the tendency to use a composite cue be learned.

Predictions were made on the basis of these hypotheses concerning the criterialities of cues under a determinant cue condition where cues are correlated with the criterion by being terms of the defining formula of the criterion and under a probabilistic cue condition where cues are related to the criterion on the mere probabilistic basis. Another set of the independent variables was the completeness of the information during the training trials.

These predictions were tested by the experimental method proposed above, using college undergraduates as subjects. Predictions were positively supported by the results, and hence the working hypotheses were supported.

Theoretical implications of these findings and the limitations and possible improvements of the experimental method were discussed.

Microfilm \$2.75; Xerox \$4.00. 73 pages.

NON-INTELLECTIVE CHARACTERISTICS OF FRESHMAN UNDERACHIEVERS, NORMAL ACHIEVERS, AND OVERACHIEVERS AT THE COLLEGE LEVEL.

(L. C. Card No. Mic 60-5221)

Ann Marie Curran, Ph.D.
The University of Connecticut, 1960

Representative samples of freshman underachievers, normal achievers, and overachievers attending the University of Connecticut in 1956-57 were obtained for the purpose of analyzing the relationship of certain non-intellective factors to scholastic success as measured by the Quality Point Ratio.

A first-semester Quality Point Ratio (QPR) was predicted for each student on the basis of his high-school percentile rank and his Cooperative College Ability Test score. The criteria for the three levels of achievement were: an underachiever was a student whose obtained QPR was at least one standard error of estimate below his predicted QPR; an overachiever was a student whose obtained QPR was at least one standard error of estimate above his predicted QPR; and a normal achiever was a student whose obtained QPR deviated from his predicted QPR by no more than one-half the standard error of estimate.

This study was limited to the following factors:

(1) study habits and attitudes towards study; (2) attributes related to academic adjustment, such as curricular adjustment, maturity of goals, use of time, study skills, mental health, and personal relations; and (3) personality traits

in the areas of general activity, social leadership, masculinity, self-confidence, and nervous tenseness. The Survey of Study Habits and Attitudes, the College Inventory of Academic Adjustment, the Guilford-Martin Inventory of Factors GAMIN, and a Questionnaire were the measuring instruments used. On the Questionnaire the students were asked to state their probable majors and to record the approximate numbers of hours per week they spent on certain activities.

The principal techniques used to analyze the scores on the tests and questionnaire data in relation to achievement status were: (1) analysis of variance, (2) t-tests, and (3) correlation coefficients.

The following findings were obtained from an analysis of the data:

1. There were over-all differences, significant at the one percent level of confidence in both cases, in the study habits and attitudes of underachievers, normal achievers, and overachievers of both sexes. According to the t-tests there were specific differences, significant at either the five or one percent levels of confidence, between all the pairs of groups except one, the underachieving and normal achieving groups of men.

2. There were over-all differences, significant at the one percent level of confidence in both cases, in the academic adjustment of underachievers, normal achievers, and overachievers of both sexes. There were significant specific differences between all pairs of groups except two: (1) the underachieving and normal achieving groups of men and (2) the overachieving and normal achieving groups of women.

3. Underachievers, normal achievers, and overachievers of both sexes did not differ significantly on any of the personality factors.

4. Larger proportions of overachievers and normal achievers of both sexes had decided on possible majors than had underachievers, but the differences were not significant.

5. Overachieving men spent more time studying than did either of the other two male groups. In both cases the differences were significant at the one percent level of confidence.

From the results obtained the following conclusions are drawn:

1. Study habits and attitudes towards study are significantly related to college achievement. Overachievers of both sexes have better study habits than normal achievers or underachievers. Normal achieving women have better study habits than underachieving women.

2. Attributes related to academic adjustment have a bearing on scholastic success. Male overachievers are better adjusted academically than either normal achieving or underachieving males. Female overachievers and normal achievers are better adjusted academically than are female underachievers.

3. The personality factors measured appear not to have a significant bearing on academic success in college.

4. The fact that a student has or has not decided on a major appears not to be related to college achievement.

5. The amount of time spent on study is related to the academic success of male students, but not the academic success of female students. Overachieving men spend more time studying than do underachieving or normal achieving men.

Microfilm \$2.75; Xerox \$7.80. 167 pages.

A COMPARISON OF THE ATTITUDES OF ABOVE-AVERAGE DROP-OUTS AND ABOVE-AVERAGE NON-LEAVERS OF INDIANA UNIVERSITY

(L. C. Card No. Mic 60-6048)

Lucy Reed Cutliff, Ed.D.
Indiana University, 1960

Chairman: Louis G. Schmidt

Problem: The purpose of the study was to determine the extent and nature of differences in the attitudes of above-average drop-outs and above-average non-leavers of Indiana University. The attitudes chosen for study were those concerning (1) Indiana University in general; (2) the curricula at Indiana University; (3) the social atmosphere at Indiana University; and (4) the extra-curricular activities program at Indiana University.

Procedures: Students who had ranked in the upper 20 per cent of their high school graduating classes, and had enrolled as first-term freshmen at Indiana University in September, 1959 were considered as above-average students. A questionnaire, designed to elicit statements of attitudes concerning Indiana University, was sent to 49 students who qualified as above-average freshmen, and who had withdrawn from Indiana University either during or at the end of the 1959-60 fall semester. The non-leavers were selected by pairing each subject in the drop-out group with a non-leaver of the same sex, high school decile rank, and English C-2 Vocabulary Test score. The questionnaire was then administered to the 49 non-leavers. The attitudes of a total of 98 students were studied. Chi square and the correlation coefficient p (rho) by the rank-difference method were the statistical techniques used to determine the differences and the relationships in the attitudes of the two groups.

Findings: (1) A significant difference was found to exist in the attitudes of the drop-outs and the non-leavers regarding Indiana University in general; (2) No significant differences existed in the attitudes of the two groups toward the curricula at Indiana University; (3) No significant differences existed in the attitudes of the two groups toward the social atmosphere at Indiana University; and (4) No significant differences existed in the attitudes of the two groups toward the extra-curricular activities program at Indiana University.

Conclusions: (1) Although the drop-outs were more dissatisfied with Indiana University in general than were the non-leavers, the drop-outs could not, or would not, point to the specific sources of their dissatisfactions any more readily than the non-leavers. (2) The similarities in the attitudes of the drop-outs and the non-leavers toward the curricula at Indiana University were more striking than the differences. (3) The drop-outs and the non-leavers were in agreement in their attitudes on the social atmosphere at Indiana University. (4) The majority of the drop-outs and the majority of the non-leavers participated in fewer student activities than they would have liked to do so. (5) The drop-outs and the non-leavers differed least in their attitudes toward the curricula at Indiana University and differed most in their attitudes toward the

extra-curricular activities program at Indiana University. (6) The drop-outs and the non-leavers were more positive than negative in their attitudes toward the curricula, the social atmosphere and the extra-curricular activities program at Indiana University. (7) The drop-outs and the non-leavers were consistent in their dissatisfactions with Indiana University. (8) Factors other than the curricula, the social atmosphere, and the extra-curricular activities program at Indiana University were responsible for attrition among above-average students at Indiana University.

Recommendations: (1) Additional research should be undertaken to determine the causes of attrition among above-average students; (2) Student-faculty relationships at Indiana University should be studied in order to establish a basis for greater mutual understanding between the students and the faculty and greater sensitivity to students' interests and abilities on the part of the faculty. (3) Consideration should be given to an evaluation of the student activities program to determine the amount of student participation and the costs required for participation.

Microfilm \$2.75; Xerox \$7.20. 154 pages.

A COMMUNITY STUDY OF ADMINISTRATOR AUTONOMY AND CONFLICTING ROLE EXPECTATIONS

(L. C. Card No. Mic 60-6080)

Raymond C. Fisher, Ph.D.
University of Oregon, 1961

Adviser: Robert E. Aggen

The purpose of this study has been to investigate possible sources of conflict between the schools and the communities which they serve. The method of research was a random sample survey of the attitudes of residents of two separate but neighboring communities in the Pacific Northwest.

Respondents were compared in terms of their attitudes towards Administrator Autonomy. The attitudes were derived by arranging in a Guttman type scale their responses concerning the ideal policy or role a superintendent of schools should stress. At one end of the scale (Low Autonomy) were found individuals who preferred their ideal superintendent to be a person who would stress discipline, economy, be a follower rather than a leader in community affairs, and have loyalties to the school board rather than his teachers in case of differences of opinion. At the other end of the scale (High Autonomy) were found people who would give an ideal superintendent more freedom to function in an autonomous role.

The hypothesis was that individuals who possessed autonomy themselves were the same group whose attitudes prescribed a highly autonomous role for their superintendent. The group who preferred a superintendent to function as a leader in his community and have primary loyalties to his teachers rather than the school board tended to be the highly educated, younger, higher income respondents.

The second major phase of the research was to determine the most likely sources of conflict between schools

and communities. Potential conflict was assumed where wide discrepancies occurred between ideal role expectations for superintendents and perception of his actual behavior. In both communities the greatest potential source of conflict was in the area of human relationships. The greatest discrepancy between ideal and actual role, as perceived by the community, referred to the superintendent's loyalties. Both communities prefer an ideal superintendent who is loyal to his teachers, yet both communities perceived their superintendent as actually having loyalties to the school board. Therefore, the superintendent's personal integrity represents the greatest source of conflict.

The final phase of the research was to compare the superintendent's awareness of community expectations and ability to perceive the most likely sources of conflict. The superintendents were interviewed separately and their perception of community expectations was noted and compared with modal community expectations. Differences between the two superintendents with regard to this type of awareness were found and it was hypothesized that some personality types might be better "tuned in" to social processes than others. Consequently, it is possible that the "other directed" personality might be more adaptable to the fluid and changing requirements of a modern mobile community than would be the "inner directed" type who is less alert to the expectations of others.

Conclusions point out that conflict between the schools and the communities may be a function of discrepant role expectations. Discrepant role expectations in turn may be a "by-product" of, and maximized by the geographical, technological, and social mobility of the culture. When confronted by an absence of consensus of expectations it is useful to know from which portions of the population the superintendent may expect support and from which segments he may expect opposition. This knowledge alone could well contribute to bringing some predictability and resultant security back to the school superintendent. His security and efficiency is derived in part from his ability to predict, and his security enhances the security and efficiency of all those for whom he is responsible.

Microfilm \$2.75; Xerox \$6.60. 139 pages.

AN INTERCORRELATIVE STUDY OF TWO CREATIVE TYPES: THE VISUAL TYPE AND THE HAPTIC TYPE.

(L. C. Card No. Mic 61-35)

Paul Brewer Flick, Ed.D.
The Pennsylvania State University, 1960

During the past decades, the problem of effective education has come to be viewed as one of motivation of students. The problem of effective motivation, then, must be approached, as one of (1) probing the individual to discover the existence of factors which predispose him to a certain level or kind of performance and (2) determining how these factors can be measured.

This study attempts to answer the first half of the problem by reviewing the work of psychologists, historians, social scientists, artists, and writers to show that a dichotomy of personality type does, in fact, exist.

It provides an answer to the second half of the problem by assembling, employing, and evaluating ten tests designed to detect the presence and measure the extent of these two types.

The two personality types which are the concern of this study are the visual and the haptic types. In an initial work in this area, Viktor Lowenfeld defined the visual aptitude as the tendency of an individual to rely on optical perception for his observation of the world; the haptic aptitude as the tendency to rely on tactile or kinesthetic sensations for perception of the world. Lowenfeld found, and subsequent tests confirmed, that individuals line up on a visual-haptic continuum according to the extent to which they rely on either visual or haptic perception, in this manner: approximately 25% are strongly visual, 25% strongly haptic, and approximately 50% fall on a graded scale somewhere between the two poles.

The existence of these two types is extremely significant for effective art education. The effective stimulation of creativity depends on employing the right stimuli for each personality type. The study shows how Paul Klee, for example, was a haptic artist, whose stimuli proceeded from his own subjective feelings of the world about him, and whose finished work reflects these feelings. In contrast to Klee is an artist like Paul Nash, who was so dependent on visual stimuli that he often picked up twigs and bits of stone to study in his studio. Artists like Van Gogh and Picasso, on the other hand, represent mixed types on the visual-haptic continuum.

This paper also points out that the visual-haptic aptitude manifests itself in areas far beyond those of art education: in writing and philosophy, in sex differences, in choice of occupation, in the development of children, in personality differences, and even in physiological differences, in each case citing recognized authorities to support the broad hypothesis.

To find an accurate measurement of this important dichotomy, the author of the study assembled ten tests: three used by J. P. Guilford earlier, one a modification of an early Lowenfeld test, six of his own creation. A Gerund Test and a Quick Response Test checked intuitive word responses to a given set of gerunds and of other words. A Drawing Test analyzed the subjects' drawings for evidence of visual or haptic aptitude. Two Tactile Tests measured the subjects' ability to transfer perception from visual to tactile senses. A Music Association Test measured the subjects' intuitive responses to music, a Visual Retention Test their responses to a quick look at a drawing. A Picture Preference Test measured the subjects' own preferences in art; a Sentence Gestalt Test and a Penetration of Camouflage Test measured their ability to distinguish words and pictures from a larger mass or ground.

On the basis of the test intercorrelations the ten tests were divided into two groups. Multiple correlation coefficients for the groups were significant at $p=.01$. It is suggested that the groups of tests measure the visual-haptic tendency in different manners.

Results showed that the tests distinguished between visual- and haptically-minded students with a high degree of reliability. In general, the tests showed certain students to be visually-minded; that is, they responded objectively, relied on their optical perception, concerned themselves with naturalistic representation, were inclined to perceive things in totality, and were concerned with images. A second group of students isolated by the test responded

subjectively, were less reliant on optical perception than on their tactile senses, concerned themselves with the expression of feeling or movement, were less inclined to perceive things in totality, and were concerned with kinesis and sensation. The majority of subjects tested, however, showed varying degrees of orientation toward either extreme.

Microfilm \$2.75; Xerox \$7.00. 147 pages.

INFLUENCE OF SEX OF COUNSELOR AND CLIENT ON CLIENT EXPRESSIONS OF FEELING DURING COUNSELING

(L. C. Card No. Mic 60-6618)

Frances Fallon Fuller, Ph.D.
The University of Texas, 1960

Supervisor: David G. Ryans

Hypotheses: It was hypothesized that female clients would express significantly more feeling than male clients regardless of the sex of the counselor, that male clients would express more feeling in the presence of male counselors than of female counselors, that both male and female clients would express more feeling in the presence of experienced than of inexperienced counselors, and that those who have a counselor preference and are assigned in accordance with their preferences would express more feeling than clients who had no preferences or were assigned counselors of the non-preferred sex.

Methodology: Preferences of 588 Reading Program University students and 534 Counseling Center clients regarding sex of counselors were tabulated by sex of subject, preference, and presenting problem. Thirty-two bona fide student clients with nonpersonal problems were counseled by 8 counselors, 4 male and 4 female, with 2 experienced and 2 inexperienced counselors in each sex group. Each counselor saw 1 male and 1 female who preferred a male and 1 male and 1 female who had no preference. This constituted the two-preference group. In addition, 4 counselors, 2 males and 2 females balanced by experience, each saw one male and one female client who preferred a female counselor. These clients plus the prefer-male and no-preference clients seen by these counselors constituted the three-preference group. First interviews were tape recorded, and client statements in counselors' case notes were scored for feeling expressed by the client using the Kelly and Fiske Relationship Index expanded and revised for use with a college client population.

Findings: Significant differences were found in the preferences of males and females. Correlation between independent scores by 2 judges of 72 sets of case notes was .85 and biserial correlation between mean scores of 2 judges and global rankings of a third judge dichotomized into emotional and nonemotional was .91. Biserial correlation between global rankings and scores of a fourth judge for 39 intake notes was .86. Correlation between scores of feeling expressed in intake when all clients were seen by an experienced male and scores of feeling expressed in first interview when clients were seen by counselors of

both sexes and experience levels was .41. The correlation between SVIB M-F scores and scores of feeling expressed in intake was -.54 for the whole group, -.38 for females, and -.14 for males.

Female clients were judged to have expressed more feeling than male clients both in intake and first interview as measured by feeling expression scores and by counselors' global post-counseling rankings. Male-female dyads were judged to have produced more feeling expression than all-male dyads.

Clients with no preference did not differ in feeling expressed from clients who preferred male counselors at time of intake when all clients were seen by a male counselor, but no-preference clients were judged to have expressed more feeling than prefer-male clients when clients were seen by both male and female counselors. No-preference clients were also judged to have increased in feeling expression more from intake to first interview than prefer-male clients, but neither of these differences was significant in the three-preference group.

In the presence of female counselors, clients were judged to have expressed more feeling than in the presence of male counselors in the three-preference group but not in the two-preference group. There was no difference in the amount of feeling expressed in the presence of experienced and inexperienced counselors.

Microfilm \$2.75; Xerox \$8.20. 177 pages.

A STUDY OF THE SELF CONCEPTS OF A GROUP OF ADOLESCENT STUDENTS AND THE RELATIONSHIP BETWEEN THESE SELF CONCEPTS AND BEHAVIORAL RATINGS

(L. C. Card No. Mic 60-6082)

Kenneth Miller Grierson, Ed.D.
University of Oregon, 1961

Adviser: John E. Lallas

Introduction

Current psychological literature shows renewed and mounting interest in the field of self-concept as an area of study of personality; yet, little of it has been directed toward the self in adolescence. In particular, little is known about how adolescents conceive of the views others have toward them.

Purpose

This study was undertaken to answer the following questions.

1. Are self-concepts of adolescents normally distributed?
2. Do adolescents who are self-deprecatory tend to think that other groups think of them in deprecatory terms?
3. Do self-enhancing adolescents tend to think that other groups think well of them?
4. Are self-deprecatory adolescents those who generally display more undesirable behavior (as observed by teachers) than self-enhancing adolescents?
5. Are self-concept discrepancies of adolescents consistent?

Procedures

One hundred pupils from four grade IX classes in one school in the city of Edmonton, Alberta, Canada, formed the sample group. Gough's adjective check list was the instrument employed to determine pupil self-concepts. A special scoring technique was devised for use in this study. The scoring was based on values assigned to each adjective in the check list in terms of placement on a self-enhancing - self-deprecatory continuum. The values were arrived at by an independent group of adolescents who rated the adjectives in terms of this continuum.

Three separate administrations of this instrument produced the three kinds of self-concepts. In the first administration the pupils were asked to check the words that applied to them. In the second administration they were asked to check the words which described how they thought their peers viewed them. In the third administration they were asked to check the words which described how they thought their teachers viewed them. From the adjectives checked, self-concept scores were calculated for each of the three different selves.

A behavioral rating scale was devised which was made up of 27 items dichotomized in terms of qualities considered desirable and qualities considered undesirable; example, trustworthy as opposed to not trustworthy. Each of the teachers dealing with the sample group rated her pupils in terms of better or worse than average on each of the 27 traits. By objective scoring, a behavioral rating score was obtained for each pupil.

The self-concept scores and behavioral rating scores were subjected to statistical tests for normality of distribution. The relationships between the different sets of scores were obtained by the Pearson product moment method.

The discrepancies between different pairs of self-concept scores were related by the Pearson product moment method.

Summary of Findings

1. Self-concept scores were distributed in a manner strongly indicating normal distribution.
2. Correlations of .55, .46 and .53 indicated positive relationships between the three selves. This suggests that self-deprecatory adolescents generally think others view them in a deprecatory manner. It also suggests that self-enhancing adolescents feel other groups think well of them.
3. There was no evidence of relationship between self-concept scores and behavioral rating scores. The correlations were -.06, -.01 and .21. This suggests that teachers' observations of school behavior give little insight into adolescent self views.
4. There was very little consistency amongst the discrepancies between different pairs of self-related views. The correlations were .17, .11 and .39.

Recommendations

1. Skilled guidance personnel are needed in schools to assist in the assessment of personality structures of adolescents. Such personnel should be responsible for informing teachers of the personality dynamics of the pupils.

2. More research would be desirable to test the validity of the findings of this study and to investigate problems which grew out of this research.

Microfilm \$2.75; Xerox \$5.00. 96 pages.

PERSONAL CONSTRUCTS AND CHOICE OF A MAJOR FIELD OF STUDY

(L. C. Card No. Mic 60-6620)

Philip Gerald Hanson, Ph.D.
The University of Texas, 1960

Supervisor: Gordon V. Anderson

The study attempts to relate some of the cognitive styles, derived from the theory of Personal Constructs by Kelly, that a person utilizes in perceiving and describing people and events to the operations involved in selecting a major field of study. The utility of these operations is manifested by noting the differences in the way an individual conceptualizes a particular vocational area (propositionality-preemptivity); how clearly he differentiates this area from other vocational areas (cognitive complexity-simplicity); how he views himself in reference to other people and to his chosen area (self identification); and how compatible his sex role is with the culturally defined sex role of the job (sex role identification). The investigation also attempts to test how consistent an individual is in his cognitive style from one area of experience (people) to another (vocational). Another purpose of the study is to assess the validity and reliability of some of the constructs in Kelly's theory and their utility in the area of vocational choice.

High or low grade point average (GPA), obtained from course work taken during the junior and senior years, was assumed to reflect a successful or unsuccessful adjustment in the pre-vocational area. This adjustment, in turn, was taken as an indication of the efficiency of the operations involved in selecting a major field of study; in this case, Engineering.

Seventy-four junior and senior Engineering students filled out personal data forms and completed the Role Construct Repertory Test (Role Rep Test), the Vocational Construct Repertory Test (Voc Rep Test), and the Strong Vocational Interest Blank for Men (SVIB). Scores on The University of Texas Admissions Test were available for all subjects. The students were divided into three subgroups based on GPA level.

The dimensions involved in the hypotheses were defined by the operations used to measure them on the Role Rep Test and the Voc Rep Test. The prediction that preemptivity would be the mode of perception most utilized by the academically unsuccessful students was not supported on the general level nor in reference to self-perception, but did receive partial confirmation in the area of Physical Science.

The more cognitively simple students were predicted to be among the students who made poor academic adjustment to their chosen program. This hypothesis was confirmed.

Students who appeared to have identified more strongly with all other figures were not among the high GPA group as predicted. Engineering students as a whole, however,

did have weaker parental identification than non-Engineering students.

The hypothesis stating that students with more pronounced masculine identification would be more compatible with Engineering and thus would be better adjusted academically to their course program was not supported. One measure of the sex role dimension did, however, differentiate Engineering from non-Engineering students.

The findings supported the hypotheses predicting consistency of cognitive style in the perception of people and vocational areas for the preemptivity and the cognitive complexity-simplicity dimensions.

Reliability studies were made for the relevant dimensions, and empirical findings, incidental to the hypotheses, but pertinent to the variables being discussed, were reported. Proposed extensions of the present research were outlined.

Microfilm \$2.75; Xerox \$7.80. 168 pages.

A COMPARISON OF LEARNER-CENTEREDNESS IN TEACHER ATTITUDES AND VERBAL BEHAVIOR

(L. C. Card No. Mic 60-6162)

Nancy Alliene Harder, Ed.D.
North Texas State College, 1960

The purpose of the study was to determine the predictive value of attitude responses in relation to verbal behavior and, indirectly, to ascertain the predictive power of the attitude instrument used in the study, the Minnesota Teacher Attitude Inventory.

The sample for the study consisted of forty public school teachers. The classrooms represented were in no way unique in relation to size, curriculum or pupil members.

The Minnesota Teacher Attitude Inventory was administered to the teachers individually. Later the teachers were asked to keep a written record of comments to pupils, calling on the student teachers who were a part of the classroom situation to assist in the recording. The instructions given to recorders were based on similar studies of verbal behavior described in the study.

The MTAI was scored with two keys: the published key and a key devised during the study to interpret attitude responses by their position in one of five socio-educational areas. The verbal behavior index for each teacher was determined through use of the verbal behavior categories found reliable by Withall in his doctoral study.

As a basis of comparison the factor of learner-centeredness was selected in that it was consistent with the description of the "superior" teacher given in the MTAI Manual and the definition of the "learner-sustaining" teacher as indicated by Withall.

The findings of this study were organized around the following: (1) presentation of means of attitude scores on the MTAI; (2) presentation of MTAI responses in relation to socio-educational emphases; (3) presentation of the results of categorizing verbal behavior; and (4) correlational analysis of learner-centeredness as expressed in attitudes and as implied in verbal behavior.

The data, in general, indicated the following:

Based on attitude responses, elementary school teachers were in greater agreement with the developers of the Inventory than were secondary school teachers. Teachers on both school levels were as a whole more learner-centered than teacher-centered with greatest attention given by elementary school teachers to principles of child development and by secondary school teachers to personal likes and dislikes of teachers.

Based on analysis of verbal behavior, the technique of secondary school teachers was found more learner-centered than that of teachers on the elementary school level. Teachers on both school levels were as a whole more teacher-centered than learner-centered with greatest emphasis given to directive statements.

Based on a comparison of percentage of learner-centeredness expressed by attitude responses and as implied in verbal behavior, all teachers with one exception showed more learner-centeredness in their attitudes than in their behavior. Relatively few teachers who indicated learner-centeredness by their attitudes practiced learner-centeredness in their behavior.

A significant conclusion drawn from the study was as follows:

The low correlation found between MTAI performance and performance reflected in verbal behavior, both interpreted in terms of degree of learner-centeredness, provided evidence of inconsistency between the attitudes the teacher holds and the behavior the teacher evidences in the classroom. Findings of the study questioned the use of the Minnesota Teacher Attitude Inventory as a predictive measure of the teacher's verbal classroom behavior. This does not, however, reflect discredit on the instrument; the Minnesota Teacher Attitude Inventory purports only to ascertain the attitudes a teacher holds toward the pupils.

It seemed from this study that serious consideration should be given in a follow-up study to factors which cause the inconsistency between a teacher's attitudes and his classroom behavior.

Microfilm \$2.75; Xerox \$6.00. 122 pages.

THE PERCEPTION OF THE
COUNSELING CLIMATE WITH
DELINQUENTS BY COUNSELORS
AT INDIANA UNIVERSITY MAJORING
IN EDUCATION, SOCIOLOGY,
PSYCHOLOGY, AND SOCIAL SERVICE.

(L. C. Card No. Mic 60-6055)

Helen Virginia Harris, Ed.D.
Indiana University, 1960

Chairman: Louis G. Schmidt

Problem

An attempt was made to determine whether differences in the pedagogical training of counselors within the departments of education, sociology, psychology, and social service led to varied perceptions of the initial counseling climate which is established with juvenile delinquents.

Procedure

In an attempt to define the counseling similarities in perception by counselors trained in varied disciplines, this research project was designed to represent four separate parallel studies. Twelve experienced and 12 non-experienced counselor judges enrolled in graduate study at Indiana University listened to four taped recordings of initial counseling sessions with juvenile delinquents. A population of 75 character traits representing three major dimensions of the counseling relationship was classified by each judge into seven categories ranging in a continuum from statements which were very characteristic of the counseling session to statements which were least characteristic of the counseling session. A total of 7,200 responses obtained through the use of Q methodology were statistically tested for item similarity by chi-square and for group homogeneity by variance analysis.

Findings and Conclusions

The inter-departmental comparisons for both the experienced and the non-experienced counselor judges in the departments of sociology, psychology, education, and social service showed that counselors from different areas of study perceived the counseling relationship heterogeneously. When the experienced and the non-experienced counselors were grouped separately in intra-departmental comparisons, great homogeneity was found within each department. The postulate was advanced that the counseling climate established with delinquents is perceived by counselors in a two-dimensional status. The primary influence upon the perception of the counseling climate was the theoretical training of the counselor, and the secondary influence was the amount of experience which the counselor brought to the counseling session.

Recommendations

1. Departments with divergent theories of counseling should set up criteria for the training of counselors which would attempt to bridge the communicational barrier which exists in the interdisciplinary areas studied. Intellectual reorientation would assist in providing a more unified outlook toward the delinquent and his problems. Conflicting ideologies should be exteroceptively, as well as interoceptively, evaluated in the social and emotional rehabilitation of delinquents.

2. A careful examination should be made to determine the manner in which the delinquent perceives the counseling relationship. It is possible that the delinquent and the counselor could both be experiencing confusion within the counseling process because they perceive the counseling climate differently.

3. Other areas of training which also come in contact with juveniles, such as police administration and psychiatry, could also be perceiving the counseling climate differently from any of the interdisciplinary areas which have been studied.

4. Further research to determine the effect which the degree of counseling experience has upon the counseling relationship would prove very enlightening.

Microfilm \$2.75; Xerox \$8.60. 189 pages.

A STUDY OF ATTITUDES TOWARD
TEACHER-PUPIL RELATIONSHIPS
UTILIZING Q-TECHNIQUE WITH THE
ITEMS OF THE MTAI

(L. C. Card No. Mic 60-6057)

Earl Joseph Heath, Ed.D.
Indiana University, 1960

Chairman: Louis G. Schmidt

The problem investigated was concerned with the resulting change in expressed attitudes when graduating education seniors in the secondary academic field were required to express a degree of preference strength to each of the items of the MTAI as compared with the usual procedure of measuring each item as a single variable. An attempt was made to determine whether a forced choice experimental test utilizing Q-technique with the items of the MTAI would be less susceptible to temporary shifts of attitudes than the regular form of the MTAI. The regular form of the MTAI measures each attitude as a single variable, and there is no opportunity for one attitude to interact with any other attitude. In this study the MTAI items were administered as Q-sorts. Each item was judged, first as a single variable, and then on its strength as it interacted with the other items.

The population in the study was 20 graduating education seniors in the secondary academic field at Indiana University and 20 experienced teachers in the secondary academic field who were graduates of the Indiana University School of Education.

The sources of data were personal data sheets from the students and from the teachers, the MTAI, and the experimental form of the test. The regular form of the MTAI was used to determine whether the selected groups were representative of students trained in the Indiana University School of Education. The Q-technique was employed with the items of the MTAI for the experimental form of the test used to test the hypothesis of a significant difference between the two groups when forced to give preference strength to their attitudes.

The statistical methods used to analyze the differences between the two groups on the experimental test were a derivation of the Pearson Product Moment Correlation formula, Fisher's formula for transforming r 's to z 's, the formula for averaging r 's, and the normal deviate test for significance. An item analysis was made to determine which items in the experimental test discriminated between students and teachers.

When graduating education seniors and experienced teachers in the secondary academic field were forced to rank the items of the MTAI by their preference for each item into a quasi-normal distribution, no significant difference was found between the groups. Therefore, subject to the limitations of the study, the conclusions presented below appear to be justified:

1. Students and teachers tend to rank statements in similar patterns, so that there are no dichotomies of teachers assigning negative positions and students assigning positive positions to the same statement as there are when the regular form of the MTAI is used.

2. Forcing students to rank statements dealing with attitudes toward teacher-pupil relationships by preference strength seems to reveal the attitudes the students will

come to hold after having teaching experience. It thus tends to eliminate the influence upon the attained results of the temporary shift of attitudes that is evident when the regular form of the MTAI is used and that comes about as a result of taking professional education courses and associating with professors and supervising teachers.

3. The expressed attitudes of graduating education seniors in secondary academic education as revealed by the forced-choice technique are significantly less permissive than is indicated by their responses to the regular form of the MTAI.

Microfilm \$2.75; Xerox \$7.20. 152 pages.

DIMENSIONS OF ADOLESCENT BEHAVIOR

(L. C. Card No. Mic 60-6621)

Percy Edwin Hindsman, Ph.D.
The University of Texas, 1960

Supervisor: Carson McGuire

This research was designed to demonstrate that there are some underlying frames of reference at work in adolescents' assessments of one another. More specifically, the following questions were asked: (a) Do sociometric valuations which adolescents are asked to make of one another depend upon something more than friendship, or the visibility a boy or girl has among age-mates?

(b) Does the factor analysis of a wide range of sociometric items, representing various dimensions of manifest behavior, produce a set of sociometric variables fewer in number and more fundamental in nature than the original tests? (c) Are there psychologically meaningful sets of cognitive and noncognitive attributes which account, in part, for the underlying frames of reference of adolescents' sociometric nominations of one another? and (d) Are there sets of cognitive and noncognitive attributes which serve as statistically significant predictors and which establish the consistency of the underlying frames of reference of adolescents' sociometric nominations?

Only a few studies reviewed in the literature have applied factor analytic techniques to sociometric data. The significance of the present research was the attempt to determine the psychological meaningfulness and consistency of sociometric factors.

The procedure involved two steps. First, in four sample populations ($N = 1242$, 608 females and 634 males), the members were asked to make assessments of one another in response to a wide range of nomination items. The 46 sets of nominations represented assessments of peer acceptance, social stimulus value, model value, role assignments, social psychological attributes, and intellectual performance. The nominations received were then transformed to stanine values and factor analyzed. Ten factors were extracted for both boys and girls, and nine for the total population. Through factor matching, five factors were found to be common to the sexes and five specific to each sex. These factors represented second order sociometric variables for which factor scores were assigned. Upon the examination of the factor loadings, the following names were assigned to the factors common to each sex: Peer Acceptance, Negative Model Value,

Social Effectiveness, Deviant Behavior, and Quiet Dependency.

The names assigned to the factors specific to boys were as follows: Avoided Brains, Artistic Temperament, Creative Imagination, Overt Impulsiveness, and Expedient Operator. The names assigned to factors specific to girls were as follows: Academic Competence, Personal Autonomy, Adult Oriented, Amoral Expedient, and Impulsive Daydreamer.

The second step was to determine, through multiple regression analyses, whether or not each common nomination factor and each factor specific to each sex was, in part, dependent upon some set of other known cognitive and noncognitive attributes of the subjects being studied. In addition, by the systematic selection of independent variables, the most efficient sets of criterion predictors were obtained from the total system of forty psychometric-type independent variables. Although not large, each of the coefficients was significantly different from zero.

From the analyses it was concluded that the nomination items were valid in the sense of being relevant to one another and combining to form meaningful factors. These factors, which represented second order variables, were predicted to a certain extent by sets of other known psychometric variables. The sets of predictors seemed to be psychologically meaningful and consistent and were interpreted as forming a part of the underlying frames of reference in adolescents' assessments of one another.

Microfilm \$2.75; Xerox \$5.60. 115 pages.

A STUDY OF THE RELATIONSHIP
BETWEEN MUSIC APTITUDES
AND MENTAL ABILITY, SCIENCE
APTITUDES, AND MATHEMATICS APTITUDES
AMONG SECONDARY SCHOOL
PUPILS IN TEXAS.

(L. C. Card No. Mic 60-6625)

Thomas Vinnedge Jenkins, Ph.D.
The University of Texas, 1960

Supervisor: C. C. Colvert

Hypotheses

The hypotheses that were tested in this study were: that there was no significant difference between the aptitudes of secondary school music and nonmusic pupils in music, science, and mathematics, and; that there was a marked or better relationship between these pupils' mental ability scores and their scores on the Drake Music Memory Test, between their scores on the Drake Music Memory Test and their scores on the Stanford Scientific Aptitude Test, and between their scores on the Drake Music Memory Test and their scores on the Numerical Section from the Differential Aptitudes Test Battery.

Methodology

Eight secondary schools were selected in Texas, from which thirty-two students were chosen by their respective counselors to take the tests mentioned in the previous

paragraph. Sixteen of the pupils selected in each school had been trained in music and were members of a school music organization, and the remaining sixteen pupils had never received training in music. The thirty-two pupils chosen at each school were to have been selected as follows: eight whose mental ability scores were 116 or higher, eight whose mental ability scores ranged between 100 and 115, eight whose mental ability scores ranged between 85 and 99, and eight whose mental ability scores were 84 or less. These scores were obtained from the California Test of Mental Maturity, 1957 edition.

Correlations were determined between the tests mentioned previously for the total population, the music pupils only, and the non-music pupils only. Between the scores on mental ability and the scores on the Drake Music Memory Test, r was found to be between .51 and .60. The r between the music and science tests was between .32 and .33, while between the music and mathematics tests r was found to lie between .37 and .46. A test was made to determine whether the differences between the music pupils' means and the nonmusic pupils' means was significant. The test was made between the means of the total music pupils and the total nonmusic pupils, and between each of the groups whose mental ability measures fall in the four categories listed earlier.

Findings

There was a marked or better correlation only between the mental ability scores and the scores of the Drake Music Memory Test. There was a significant difference between the means of the music pupils and the means of the nonmusic pupils in the total numbers of each group and in each of the four subgroups. There was found to be no significant difference between the means for any group or subgroup on any of the other tests.

Microfilm \$2.75; Xerox \$4.60. 89 pages.

SOME PROBLEMS OF NEGRO
TEACHERS RELATED TO
INTEGRATION OF PUPILS IN
PUBLIC SCHOOLS

(L. C. Card No. Mic 60-6059)

Mae Elizabeth Kaufman, Ed.D.
Indiana University, 1960

Chairman: G. T. Somers

Problem

The purpose of this study was to find some of the problems of Negro teachers growing out of integration of pupils in public schools. More specifically, the problem was to find (1) their preferences concerning ideas and policies of integration of pupils in public schools, (2) what problems they had encountered and what general problems they could identify for Negro teachers due to such integration, and (3) what losses or gains they could see for Negro teachers from the sum of all the problems due to integration of pupils in public schools.

Procedure

Fifty-six Negro teachers selected from Louisville, Kentucky, and from Jeffersonville and New Albany, Indiana, were interviewed with the aid of a questionnaire. Answers were tabulated and graphed. Consistency of each individual's ideas concerning a principle in theory and that principle in action was checked, and profiles were made showing patterns of consistency.

Findings

Some of the major findings were:

1. All 56 teachers, preferred the basic principle of integration of pupils in public schools. However, in practice only 14 per cent preferred integration of pupils even if many or a majority of Negro teachers would lose their jobs, while the majority, or 82 per cent, preferred integration of pupils only if the jobs of competent Negro teachers were secure, and four per cent were undecided.
2. Tendency profiles based on three sets of paired questions revealed that few teachers had a straight-line integration profile. The most persistent tendency, however, was the integration tendency, and the most persistent deviation advocated integration of pupils only if competent Negro teachers' jobs were secure.
3. Negro teachers met many problems as a result of integration of pupils in public schools such as loss of jobs, placement in non-teaching jobs, placement in teaching jobs they were not trained for, etc. The majority indicated they met the problem of the return to Negro schools of the Negro children who failed to adjust in integrated schools that were predominantly white with white faculties. No one checked the problems of more disrespect from white children and more disrespect from white parents. The respondents indicated many problems they felt were confronting Negro teachers, two of which, "few new Negro teachers employed" and "teachers not integrated when pupils integrated," were checked by 91 and 89 per cent of the respondents, respectively.
4. The majority, 42, of the Negro teachers in this study, felt Negro teachers had suffered losses due to the change; however, 15 of these felt there were gains also, and 13 felt there were gains and no losses. The majority felt that employment was the area in which the greatest losses had occurred.

Conclusions

The following major conclusions were drawn from the data:

1. All Negro teachers in this study believed in the basic principle of integration of pupils in public school, but the majority were not willing to accept integration of pupils at the price of their jobs.
2. Most of the problems of Negro teachers had seemed to grow out of the administration's failure to integrate teachers when they integrated pupils and out of its policy of liberal transfer privileges for pupils. It seems that most of the problems might be solved by total integration and a stricter transfer rule.
3. It seems, on the basis of some evidence in this study, that white children and white parents have accepted Negro teachers in mixed classes.

Microfilm \$2.75; Xerox \$7.40. 157 pages.

THE INFLUENCE OF REPETITION ON THE OVER-ALL AESTHETIC QUALITY AND THE COMPLETION TIME OF A CREATIVE ART TASK

(L. C. Card No. Mic 61-44)

Vernon Dale Kendrick, Ph.D.
The Pennsylvania State University, 1960

The primary focus of this study was upon those significant changes in over-all (gestalt) aesthetic quality that might appear in the final product of a creative art task, if the same task was repeated and if the intervals of time between the repetitions of the same task were varied. Included in the study were the changes in time (in minutes) taken to complete the creative art task with each repetition of the same tasks and with varied intervals of time (days) between repetitions.

The study further attempted to show the differences in the over-all aesthetic quality of the repeated art tasks between students ranked as having the most creative ability and those students ranked as having the least creative ability.

Six groups of college students, total population of 95, were asked to repeat a creative art task, employing twenty-four (24) pieces of pre-cut construction paper. One, seven, fourteen, twenty-eight, forty-nine and ninety-eight days were the intervals between the repetition of each respective group.

The analysis of the data (t tests) showed that there was no significant gain in over-all aesthetic quality between the initial experience and the "last" repetition of the art task.

Between the initial experience and the "first" repetition, the groups with 1, 7, 14, and 28 days between their repetitions showed approximately 68%, or 7 out of every 10 students increased significantly (chi square) the over-all aesthetic quality of their art tasks, while approximately 32%, or 3 out of 10 students had a loss in over-all aesthetic quality. Between Repetition I and II, only 44%, or approximately 4 out of every 10 students had an increase in the over-all aesthetic quality and 56%, or approximately 6 out of every 10 students seemed to have a decrease.

The students ranked as having the "most" creative ability seemed to significantly increase (analysis of variance) the aesthetic quality of their art tasks over the art tasks of those students ranked as having "least" creative ability. This seemed to be evidenced primarily between the initial experience and the "first" repetition of the art task, and was not found to be true between repetitions I and II and III.

Group mean gains in over-all aesthetic quality of all six groups, between the initial and "first" repetition showed a significant difference (analysis of variance). Those groups with smaller intervals of time between their repetitions of the art task had seemingly higher mean gains than those groups with larger intervals of time between their experiences.

Within group coefficients of correlation of over-all aesthetic quality between repetitions showed an orderly drop in the groups' *r* averages in relation to the interval of time (days) between the repetitions. All things being equal, it seemed that the closer the repetitions of the art task, the higher was the relationship of the aesthetic quality of the task, while the further apart the repetitions

of the art task, there seemed to be little or no relationship.

The time (in minutes) taken to complete the art task decreased in a straight line drop with a leveling-off tendency showing at the "last" repetition.

The number of repetitions and the different intervals of time between the repetitions of the six groups did not significantly affect (analysis of variance) the degree of judged similarity or dissimilarity as found between the art tasks of each individual.

Microfilm \$3.35; Xerox \$11.70. 258 pages.

THE DETERMINATION AND DESCRIPTION OF VARIOUS CREATIVE ATTRIBUTES OF CHILDREN

(L. C. Card No. Mic 61-46)

Clarence E. Kincaid, Ed.D.

The Pennsylvania State University, 1960

The past several years have witnessed an accelerated effort to identify various attributes of creativity. This study originated from the realization that very little research has been concerned with the analysis of creativeness as observed in child art.

The basic problem of this investigation was to develop objective measures capable of assessing different attributes indicative of varying degrees of creative behavior as seen in the art products of children. Findings resulting from this primary problem afforded the opportunity to evaluate related questions, i.e., determining the relation between chronological age and creative ability, investigating the enigma pertaining to the relationship and variability of aesthetic quality and creative imagination, and the effectual differences of various motivations regarding the promotion of creativity.

Four descriptive terms were employed in this study. They are: (1) child art; this term was defined as the art expression reflecting those developmental levels characterized by unconscious expression of children generally between the ages of five and twelve, (2) adult art; this term was interpreted as that expression occurring beyond the level of child art which is characterized by conscious expression, (3) creative imagination; this term was used to describe the ability to project uncommon interpretations, and (4) aesthetic quality; this term applied to that aspect of pictorial representations that is concerned with the evaluation of the elements of art, e.g., line, color, composition, rhythm, and value patterns.

Eight different tests were employed which were either originated for this study or were adapted from various measures used in previous investigations concerning the creative attributes of adults. In addition to responses of these tests, the respondents were given three motivations and asked to draw pictures. The drawings were evaluated by five judges on the basis of creative imagination, aesthetic quality, developmental level, and the selection of the most creative drawing of each respondent.

Two populations were secured for this study--an original population of seventy-five individuals, and a validating population of sixty-six children. From the original population, a child art group was extracted with 7.97 years

as the average age. This group was given the eight tests and the three motivations. On the basis of the statistical findings of this group, four tests and two motivations were selected to be administered to the validating population representative of an average age of 8.0 years. The findings resulting from the validating population were comparable to those of the original child art group; however, final conclusions were based on the findings resulting from a synthesis of the two groups.

A multiple R of +.70 significantly indicated that creative imagination can be determined with a considerable degree of accuracy by the collective predicting ability of four particular tests presented in this study. With reference to the chronological age factor, a tendency exists for children's creative imagination to increase up to the age of fourteen, and then decline. A correlation of +.52 indicated the relation between creative imagination and aesthetic quality of the drawings; however, regarding the child, creative imagination is significantly more evident than aesthetic quality. As maturity increases, this situation is reversed to some degree. It was also found that motivations concerned with unusual objects resulted in more creative drawings than those of familiar forms. The more creative child is comparable to the creative adult in most respects, such as flexibility, fluency, elaboration, redefinition, and originality. However, the findings of this investigation indicated that creative children differ from creative adults in that the creative child does not necessarily respond to or project asymmetrical arrangements.

Microfilm \$2.75; Xerox \$6.20. 130 pages.

THE MEASUREMENT OF SOCIAL COMPETENCE IN PRESCHOOL CHILDREN

(L. C. Card No. Mic 60-6711)

Samuel Levine, Ed.D.

Stanford University, 1960

The concept of social competence was explored, and a scale for its measurement for preschool children was proposed. The basic hypothesis of this study was that the proposed scale, called the San Francisco Social Competency Scale, would reliably discriminate between chronological age groups of preschool children. The relationship of social competence to the child's sex; ordinal position; the number of siblings; and parental age, education, income, and occupation was determined.

The San Francisco Social Competency Scale consists of three subscales: Self-Help, Initiative-Responsibility, and Social Skills, which are summed providing a total social competency score. The sample consisted of 175 males and 150 females between the ages of 2 and 5 who attended cooperative nursery school programs in the San Francisco Bay Area. The ratings were provided by the children's mothers at the adult education meetings during the spring of 1959.

The hypothesis that the San Francisco Social Competency Scale would reliably discriminate between chronological age groups of preschool children was confirmed. The subscale and total score correlations with chronological age were all significant beyond the .01 level. The reliability of the subscales and total score was computed

by the odd-even method, corrected by the Spearman-Brown Prophecy Formula. In general, the reliability coefficients are sufficiently high to suggest relatively good internal consistency (median $r = .84$).

Significant sex differences were found on the SH and the IR subscales in favor of the females, the F ratios being 3.97 ($P < .05$) and 6.80 ($P < .01$) respectively. The t -tests for the Self-Help subscale at the separate age groups between males and females were non-significant. However, the IR subscale scores significantly favored the females at CA 3 ($P < .05$) and at CA 5 ($P < .01$). The significant F ratios appear to be due to the cumulative effect of statistically non-significant differences rather than consistent item differences over the preschool age group. The Social Skills and Total Score analyses of variance were not significant.

The item means for each subscale for males and females at each age were rank ordered. The magnitude of the mean score determined the item's difficulty level. The stability of the item means across the age groups for both males and females was significant beyond the .01 level. The agreement between the item mean rankings for males and females at each age group also exceeds the .01 level of significance.

A frequency distribution was made of the five items within each subscale which the mother felt were most important to her child's social competency development. These were then rank ordered and are referred to as "cruciality rankings." In general, there was no relationship between the cruciality rankings and item difficulty for the subscales. The agreement of the cruciality rankings between males and females for the subscales was significant for each age ($P < .05$). It was suggested that the sex differences on the present scale are not due to a difference in behavioral emphasis between mothers of males and mothers of females. The stability of the cruciality rankings across age groups was, likewise, significant beyond the .01 level.

In general, the correlations of the social competency subscales and total score with the amount of preschool experience; number of siblings; and parents' age, education and income were non-significant. The families are primarily from the upper-middle socioeconomic group. It is suggested that the social competency correlations with these variables in the general population are not reflected by the obtained correlations within this homogeneous sample.

Recommendations for the refinement of the San Francisco Social Competency Scale and suggestions for research were presented.

Microfilm \$2.75; Xerox \$6.40. 134 pages.

THE ACADEMIC AND SOCIAL ACHIEVEMENT, AND INTELLECTUAL STATUS OF A GROUP OF RESIDENTIAL SCHOOL CHILDREN BLINDED BY RETROLENTAL FIBROPLASIA.

(L. C. Card No. Mic 60-5819)

John David McGann, Ed.D.
Boston University School of Education, 1960

I. THE PROBLEM

Statement of the Problem. The purposes of this study were as follows: (1) to examine and analyze the academic achievement of a group of residential school children blind as a result of retrolental fibroplasia; (2) to determine the educational comparability of this group with a residential school population blind for other reasons; (3) to investigate the distribution of intelligence within the retrolental fibroplastic population; (4) to determine their intellectual comparability with a residential school population blind for other reasons; (5) to inquire into the social adjustment of the retrolental fibroplastic as compared to that of other residential school children blind for different reasons.

II. METHODS AND MATERIALS

The study population consisted of one hundred and sixty-eight children and youth in residence at the Perkins School for the Blind, Watertown, Massachusetts. These subjects were in the grade range Third through Thirteenth or in special classes. Data which were collected on this group and utilized in the study included sex, age, grade placement, diagnoses of visual pathology, visual response, presence of and type of additional handicaps, guidance referrals, including numbers, type and disposition of such referrals, as well as tested intelligence, conduct, effort, achievement test performance and academic grade scores. Data on achievement test scores and academic grade scores were collected for periods up to four years.

In an attempt to utilize the data in an exacting way and to provide for sensitive comparisons, subjects showing similar characteristics were grouped and treated as distinct entities. Such subgroups included the Visual Response Group, Special Class Group, Multiply Handicapped Group, Superior Intelligence Group, Intensive Grade Range Group, and, further, the population was divided into eight diagnostic groups according to optical pathology. An additional subgroup known as the Composite Group and containing all subjects with a diagnosis other than retrolental fibroplasia was also utilized. Inter-group and inter-group comparisons were made on the basis of all of the study data.

Information regarding the techniques and results of statistical analysis was presented. The null-hypothesis as to there being no difference other than could be attributed to chance between a group of subjects blind as a result of retrolental fibroplasia and another group of subjects with diverse diagnoses was introduced. Forty-seven analyses of variance were developed, as well as models supporting the means by which such analyses were used.

A review of the literature was presented and particular attention was given to materials bearing on the physical, social, emotional, intellectual and academic development of the retrolental fibroplastic child. In addition, the

academic achievement and intelligence tests which were used with the study population were discussed and especially with reference to those adaptations necessary for their utilization with such a population. Further, all sources of diagnostic information were noted as were also the bases for subgroup development. Terminology was defined and seventy-nine tables and two figures supplemented the text.

III. CONCLUSIONS

It was concluded within the limitations of the methods employed in this study that:

1. The Retrolental Fibroplastic Group was not significantly different in academic performance from other optical pathology groups excepting in the area of Arithmetic.
2. The social adjustment of the Retrolental Fibroplastic Group was not markedly at variance with that of other optical pathology groups in this study.
3. There was no important difference between the Retrolental Fibroplastic Group and other optical pathology groups in tested intelligence.
4. The division of sex within the Retrolental Fibroplastic Group tended to be more equal than among other optical pathology groups.

In order to further substantiate the conclusions of this study larger groups of randomly selected subjects would need to be utilized in a more extensive and intensive study.

Microfilm \$2.75; Xerox \$9.25. 203 pages.

SCHOLASTIC ABILITY, SELF-CONCEPT AND OCCUPATIONAL PLANS.

(L. C. Card No. Mic 60-6816)

Allen Henry Nauss, Ph.D.
University of Missouri, 1960

Supervisor: Robert Callis

Purpose. Little research has been carried out to identify characteristics of highly gifted male adolescents in comparison with others who are gifted but not highly so. It was the purpose of this study to determine if accuracy of self-concept and adequacy of occupational planning were singularly related to high scholastic ability when two groups of gifted students were compared.

Method. Two groups of male college freshmen were selected. The high group consisted of 39 subjects who ranked in the top 2% of entering University of Missouri freshmen on the School and College Ability Test (SCAT). The near high group included 52 subjects who obtained scores at the 84th or 85th percentile rank. Hypotheses of no difference between the groups in the areas of self-concept and adequacy of occupational planning were tested.

Self-estimates of scholastic ability, study habits and attitudes, and vocational interests were used as measures of self-concept, and were compared with test scores of the respective characteristics to determine accuracy of self-concept. Judgments of the adequacy of subjects' occupational plans: level, and occupational plans: field were used as measures of adequacy of occupational planning.

Combinations of the data from the two major areas were also developed to test for differences between the groups.

Subsidiary analyses were made to describe the groups and differences between them so that analyses of self-concept and occupational planning would have maximum meaning.

Summary. The groups differed in all ability and achievement indices used besides the SCAT, with the high group obtaining the higher means.

Results of the subsidiary analyses were in agreement with other investigations comparing groups of high and average ability in finding that high ability students 1) have parents who are more frequently employed in professional occupations, 2) more frequently prefer literary activities, according to the Kuder Preference Record Vocational, 3) may be characterized by inefficient study habits, and 4) are not different from a normal population in the number of A and B+ scores on the Strong Vocational Interest Blank nor in the occupational level score on the SVIB. However, in comparison with parents of 1956 National Merit Scholars, a greater number of parents of subjects in this study were employed in agricultural and service occupations.

Agreement with other studies in comparing high and near high ability groups appeared when subjects of high ability showed more primary patterns in SVIB vocational interest areas of Biological Sciences, Physical Sciences, and Verbal-Linguistic. The high group also aspired to higher levels of educational attainment than did the near high. However, in comparison with parents of Terman's gifted group, more parents of the high subjects had some college education. More of the high and also of the near high subjects than of Terman's gifted boys were firstborn or only children in the family, but the high subjects as a group were not accelerated in school as were Terman's subjects.

Other results included findings of accuracy of scholastic ability estimates and overestimation of study habits on the part of both groups.

Conclusions involving the major hypotheses suggest the following: Male college freshmen of high ability are not different from those of near high ability in accuracy of self-concept and adequacy of occupational planning, nor when accuracy of self-concept and adequacy of occupational planning are considered together.

The findings show, however, that subjects of both groups were realistic in selecting a level of their occupational choice appropriate to their judged occupational ability.

In general, male college freshmen of high ability showed no superiority to those of near high ability in accuracy of self-concept and adequacy of occupational planning.

Microfilm \$2.75; Xerox \$9.45. 209 pages.

COUNSELOR ATTITUDES AND LEVELS OF COUNSELOR CERTIFICATION

(L. C. Card No. Mic 60-6818)

George Thomas Peters, Ed.D.
University of Missouri, 1960

Supervisor: John L. Ferguson

PURPOSE: To investigate certain occupational attitudes of selected groups of public school counselors. Specifically, the intent was to determine whether counselors by varying levels of counselor certification perceived selected occupations differentially with respect to their expression toward the factors of salary, social status, training, aptitudes and abilities, and like to be, and whether they perceived the occupational factors differentially.

PROCEDURE: To obtain information, an occupational factors rating scale based on selected occupations was sent to 100 teachers and 394 counselors with a total of 389 persons responding. The returns were analyzed on the basis of a separation of counselors by level of certification and by sex with the same division into male and female subjects for the teachers. The four levels of counselor certification considered were the non-certified, temporary, teacher-counselor and professional.

SUMMARY:

Findings Relating to Differences Among Groups

- (1) The pattern of response among groups indicates a high degree of similarity.
- (2) Social status was found to be the major factor for which perceptual differences were found to exist with differences noted among the male and combined male and female groups.
- (3) For the combined male and female groups on social status, there was similarity among the four counseling levels for it was found that the only significant differences among the groups were between teachers and counselors.
- (4) The female groups differed significantly in their perception of aptitudes and abilities with a high number of significant differences existing among the counseling groups themselves.

Findings Relating to Differences Among Factors

- (1) For the occupational factors, each of the occupational groups responded differentially.
- (2) Significant differences were perceived among the factors for males, females, and males and females combined by all groups.
- (3) Social status and training appear to be the most dominant factors in comparison with aptitudes and abilities and like to be.

Findings Relating to Differences Between Sexes

- (1) For significant differences between the sexes, it was found that the males were more responsive to the factors than the females.
- (2) With regard to significant differences between the sexes, it was found that males and females differed in their perception of salary and aptitudes and abilities to a greater extent than to the other factors.

CONCLUSIONS:

- (1) In so far as certificated counselor groups are concerned, the pattern of response indicates a high degree of similarity. It would also appear that while some differences were found to exist between certificated and non-certificated groups including teachers, they seem to hold similar attitudes.
- (2) Each of the occupational groups responded differentially to the occupational factors. In general, the groups tend to respond more frequently to the salary, social status and training factors than to aptitudes and abilities and like to be.
- (3) Sex differences do exist within all occupational groups on a majority of the occupational factors.
Microfilm \$2.75; Xerox \$7.60. 165 pages.

TEACHERS' AND PUPILS' PERCEPTIONS OF PUPIL PROBLEMS IN HONOLULU PUBLIC HIGH SCHOOLS

(L. C. Card No. Mic 60-6712)

Ione Jean Alohilani Rathburn, Ed.D.
Stanford University, 1960

The study was designed to investigate variations in the kinds of pupil problems perceived by pupils and teachers in the public senior high schools in the City and County of Honolulu; to determine the extent to which pupils and teachers feel these problems are recognized by the schools; and to infer the meaning the foregoing inquiries have for the planning and functioning of high school guidance services in Honolulu.

Procedure

The Instrument

A checklist based on items in the Mooney Problem Check Lists was used to determine pupils' and teachers' perceptions of five major kinds of problems: vocational; academic; personal-social; financial; and health. The checklist allowed teachers and pupils anonymously to indicate the intensity of problems in each of the five areas by checking one of three columns: Rarely or Never; Sometimes; Very Much.

Reliability:--The test-retest procedure with a two week interval was used to check the reliability of the instrument. A coefficient of stability of .85 was obtained for the entire checklist, using the Pearson product moment coefficient formula.

Validity:--The assumptions relevant to validity were the same assumptions upon which the Mooney Problem Check Lists and the S. R. A. Inventory were developed. Other problems related to the validity of instruments of this type are discussed.

The Sample

The sample consisted of 963 pupils and 147 teachers representing the five urban and six rural public high schools with the full three grades in the City and County of Honolulu.

Method of Analysis

Teachers' and pupils' perceptions of problems were analyzed: (1) by categories or types; and (2) by items. The chi square test was used to test the association between pupils' and teachers' perceptions of problems, by categories. The statistical significance of differences among independent percentages was determined in the item analysis. A significance level of $P=.05$ was used for rejecting the null hypothesis.

Results

Pupils checked problems with the greatest frequency in the following order: vocational; academic; financial; personal-social; and health. No significant variations among the following sample divisions were found to exist: schools, urban-rural location, sex, grade-level, and college bound versus non-college bound designation.

Pupils perceived the amount of school help as being greatest in terms of the following order of problems: academic; vocational; health; personal-social; and financial. College bound pupils marked items of the academic and vocational types as being given more help by schools than did the non-college bound.

No significant differences were found to exist between teachers' and pupils' perceptions of major types of problems when compared by individual school and by urban-rural location. In their voluntary responses of what constituted pupils' greatest problem, however, teachers ranked personal-social problems first as compared to third by pupils.

Teachers' perceptions of amount of school help with problems varied significantly from those of pupils.

While they were concerned with problems in all areas, pupils were most concerned with problems of a vocational nature. Pupils' voluntary and checklist responses revealed the same results.

Conclusions and Recommendations

The findings of the study indicate general agreement between teachers and pupils about the major areas of pupils' concerns. Examination of specific problems reveals some differences in terms of relative importance of problems between the two groups and among the various groups of pupils within a school. Pupils' and teachers' perceptions of the amount of school help with problems varies somewhat, also.

Pupils' expressed concerns with various problems provide clues for the inclusion in the curriculum of organized help as well as emphasis in all problem areas. Pupils'

special concern with vocational problems emphasizes the need for over-all planning and full participation on the part of all community agencies in helping to meet this problem. Microfilm \$2.75; Xerox \$8.60. 188 pages.

A STUDY TO DETERMINE SOME RELATIONS BETWEEN CHANGES IN READING SKILLS AND SELF-CONCEPTS ACCOMPANYING A REMEDIAL PROGRAM FOR BOYS WITH LOW READING ABILITY AND REASONABLY NORMAL INTELLIGENCE

(L. C. Card No. Mic 60-6164)

Lesten Clare Seay, Ed.D.
North Texas State College, 1960

The problem of this investigation was to determine some relations between changes in reading skills and changes in certain selected aspects of self-concept, accompanying a clinical reading program for elementary school boys with low reading ability and reasonably normal intelligence.

The experimental population was composed of seventy-two reasonably normal boys enrolled in grades four through seven. They were considered reasonably free of physical and intellectual defects but were having reading difficulties and were attending reading clinics. A control group was formed by matching each experimental subject with another boy of approximate age, grade, and language factors intelligence quotient. These boys had no reading problems.

The California Test of Personality and the Reading Test of the California Achievement Tests were administered to both groups. After approximately seventeen weeks of school (which included several days each week of individualized clinical instruction for the experimental group), retests in reading achievement and self-concept were administered to the experimental and control groups. Changes in reading levels and in self-concept levels were determined for both of these groups.

Solution to the problem was sought through the testing of four hypotheses.

The tenability of the first two hypotheses was determined from the initial test data of self-concept scores and reading grade placement deviations from actual grade placements of both groups. The tenability of the last two hypotheses was computed from the differences in reading levels and self-concept levels of the groups' initial test and retest data. Pearson's product moment coefficients of correlation were statistically computed from the data to check the tenability of the first and fourth hypotheses. Fisher's *t* technique was used in computing the significance of the difference between the two groups' means for reading levels and self-concept levels.

(a) For boys with approximately normal and equal language factors of intelligence, there is a significant positive relationship between personal, social, and total self-concept levels and levels of vocabulary, comprehension, and total reading skills. Correlation of total reading skills with total self-concept was .319 for the control group and .359 for the experimental group.

(b) For boys with approximately normal and equal

language factors of intelligence, no significant differences were found to exist between levels of self-concept of pupils with persistent reading problems and levels of self-concept of pupils with reasonably normal reading abilities. The null hypothesis was accepted at $P=.10$ for the differences between the two groups' means for personal, social, and total self-concepts.

(c) Changes in social self-concept levels and changes in total self-concept levels seem to be positively associated with experiences in a clinical remedial program. Changes in personal self-concept levels do not appear to be significantly associated with these experiences. The null hypothesis was accepted at $P=.001$ for the significance of mean changes in personal, social, and total self-concept of the experimental group. It was rejected at $P=.10$ for the significance of mean changes in social and total self-concept levels of the control group; however, it was accepted at $P=.01$ for this group's significance of mean change in personal self-concept level.

(d) Changes in levels of vocabulary, comprehension, and total reading skills, associated with experiences in a clinical remedial-reading program, are each positively (but not significantly) related to corresponding changes in levels of personal, social, and total self-concept.

Microfilm \$2.75; Xerox \$8.00. 173 pages.

THE RELATIONSHIP BETWEEN HUMAN VALUES, AESTHETIC PERFORMANCE, AESTHETIC SENSITIVITY, AND SENSITIVITY TO PROBLEMS.

(L. C. Card No. Mic 61-66)

Robert Charles Seelhorst, Ed.D.
The Pennsylvania State University, 1960

I. Introduction

This study attempts to determine whether or not there are any relationships between human values and certain aesthetic orientations among college undergraduate and graduate students. More explicitly, it attempts to determine the relationships between: (1) human values and aesthetic performance, (2) human values and aesthetic sensitivity, (3) human values and sensitivity to problems, (4) aesthetic performance and aesthetic sensitivity, (5) aesthetic sensitivity and sensitivity to problems, (6) sensitivity to problems and aesthetic performance, (7) interrelationships derived from these.

II. Population

The population in this investigation consists of one hundred nine students, ranging from undergraduate elementary students through junior and senior art education majors to graduate students in art education.

III. Source of Data and Procedure

The data in this study were obtained from the following measures:

1. Values - A test entitled "Ways to Live" document constructed by Charles Morris and reported by him in his

book, *Varieties of Human Value*, was used as the measure of value orientations. Morris had done a factor analysis of the "Ways" and it was decided to use the five factors which emerged from the analysis for the basis of this study.

Factor Scores were determined for each student on each factor. The five Factors and their names were: Factor A: Social Restraint and Self-Control; Factor B: Enjoyment and Progress in Action; Factor C: Withdrawal and Self-Sufficiency; Factor D: Receptivity and Sympathetic Concern; Factor E: Self-Indulgence (or Sensuous Enjoyment).

2. Aesthetic Performance - Following a taped motivation, each student was asked to paint. These products were judged by seven expert judges to determine an Aesthetic Performance Score.

3. Aesthetic Sensitivity - After Beittel's test had been rescored it was used to obtain an Aesthetic Sensitivity Score.

4. Sensitivity to Problems - Gullford's test of Sensitivity to Problems was used to obtain a Sensitivity to Problems Score.

IV. Analysis of Data

After the various scores were obtained, product-moment coefficients of correlation were computed to determine the closeness of the relationships.

V. Conclusions

The following conclusions are based upon the data and conditions of this study:

1. It appears there is a significant relationship between certain value orientations and Aesthetic Performance. Factors B and E produced significant negative correlations with Aesthetic Performance and Factor C and Aesthetic Performance gave a significant positive correlation. This seems to indicate that those students who internalize their values performed better aesthetically than those students who were more oriented toward society.

2. There appears to be no relationship between the value orientations and Aesthetic Sensitivity, and Sensitivity to Problems.

3. There appears to be a relationship between Aesthetic Performance and Aesthetic Sensitivity. These two do not appear related to Sensitivity to Problems.

4. Certain relationships appear to exist between the present study and Cardinet's "Esthetic Preferences and Personality," Murray's *Explorations in Personality*, and Morris' studies.

5. The graduate students reflected the results in the total group more than any other group.

Microfilm \$2.75; Xerox \$7.20. 151 pages.

A SURVEY OF OPINIONS UPON THE OCCUPATIONAL ROLE OF THE REHABILITATION COUNSELOR

(L. C. Card No. Mic 60-6822)

Carroll Edwin Smith, Ph.D.
University of Missouri, 1960

Supervisor: John F. McGowan

This study was designed as an attempt to identify areas of agreement or disagreement concerning the rehabilitation counselor's occupational role by sampling the opinions of three groups of rehabilitation personnel.

The data concerning opinions of the rehabilitation counselor's occupational role were obtained from a questionnaire composed of eight summated-rating scales. The scales were constructed, on the basis of expert judgment, from a larger number of items obtained from; rehabilitation counselors, rehabilitation students, and from a review of the pertinent literature. All of the items used pertained to some type of activity which might be performed by a rehabilitation counselor in the course of his work. The eight scales were given the following titles:

1. Counseling
2. Testing
3. Office Routine
4. Placement
5. Incidental Services
6. Occupational Information
7. Public Relations
8. Counselor Self-Improvement

The final questionnaire was mailed to a sample of rehabilitation personnel: counselors, directors and supervisors, students in graduate training in rehabilitation counseling. The samples of counselors and students were all from the midwestern United States; the directors and supervisors were distributed throughout the continental United States.

The returned questionnaires were evaluated by the use of analysis of variance. The hypothesis tested was that of independent, random samples from a common population. In those cases where the separation in mean opinion scores between the three groups were so divergent that the probability of chance occurrence was less than five per cent; the above hypothesis was rejected in favor of the hypothesis of significant difference in opinion, for the particular occupational area so evaluated.

The analysis of mean opinion scores gave significant results in the areas of placement, incidental services and public relations. Since the mean scores of the counselors and supervisors were quite close on these scales, it seems probable that the lower scores of the student group were the important factors in producing these results. The students mean opinion score was considerably higher on the testing scale, but the result is ambiguous because the variances of the three groups were significantly different at the five per cent level.

The questionnaires for the counselors were divided by state into eight groups representing the eight states included in the counselor sample. The same type of analysis as that described above for the main groups showed significant differences between the counselors, grouped by state, on the following scales; (1) counseling, (2) testing, (3) office routine, (4) placement, (5) incidental services,

(6) occupational information (7) public relations. The most striking of these differences occurred in the testing area where the counselors fell into two clearly opposed groups. One group placed testing high; the other low, as a factor in the rehabilitation counselor's job.

The student group was sub-divided according to the particular school attended and analyzed in the same manner as that described for the main groups. Significant differences in opinion among these groups were obtained on the testing, counseling, office routine, placement, incidental services and public relations scales.

On the basis of these results, it was concluded that there is significant disagreement in opinion between the main groups as to the counselor's proper occupational function in the areas of placement, incidental services and public relations.

Although the differences are not as marked as those observed in the main group comparisons, there are significant differences among the counselors separated by state, and among students separated by school.

It was suggested that the differential emphasis given to particular areas might lead to some difficulties in communication between these groups. Therefore, attempts to reach a mutually acceptable definition of the rehabilitation counselor's occupational role would seem to be a worthwhile project.

Microfilm \$2.75; Xerox \$7.00. 146 pages.

COUNSELING AND GUIDANCE PROGRAMS IN JUNIOR COLLEGES OF THE UNITED STATES

(L. C. Card No. Mic 60-5521)

Cornelia Klipstein Fry Sowell, Ed.D.
Texas Technological College, 1960

Chairman: Lewis B. Cooper

Each member of the junior college staff should understand the functions of the guidance program so he may help young people on the campus to become happy, mature, productive, self-reliant world citizens. The purpose of this study was to present an analysis of the current counseling and guidance programs and to make recommendations for improvement.

The normative survey technique was used because of the nature of the problem. Four hundred eighty-five questionnaires were sent to deans of student life in the junior colleges of the nation. Of these more than two-fifths were returned. One hundred fifty-eight usable returns were divided into three approximately equal groups for statistical analyses and evaluative purposes: Group I, those junior colleges with full-time day enrollment below 250 students; Group II, 250 through 500; and Group III, above 500 students.

Findings revealed that nearly all junior colleges have some good phases of guidance services; however, some need to be improved. The following recommendations for improvement were found:

1. Each junior college should have a counseling and guidance service, directed by a person professionally-trained and certified in the field of counseling, and related

areas such as psychology and psychometry. If the current director does not meet these qualifications, then he should be encouraged and required to qualify on a postponed basis, through formal courses and directed experience, within a certain time.

2. The guidance staff--the counselors, psychologists, psychometrists--should be encouraged and required to qualify for the pupil personnel credential within a stipulated period of time. Consulting psychiatrists, nurses, case workers, etc. should be encouraged to take counseling seminars, workshops, etc. and to read extensively in current counseling literature.

3. In-service programs best suited for the particular junior college should be instigated or improved. Personnel should include the administration, the classroom teachers, and guidance workers. Better intra-school relations and better working conditions through an understanding of the guidance program should result.

4. With an improving, functioning guidance program underway, a budget adequate for meeting current and expanding functions should be requested and expected. An accurate account of actual expenditures should be kept to verify and justify the larger allocation received.

5. To secure each student's test profile for interpreting in view of possible vocations, a non-credit vocational guidance course should be required of all entering freshmen. In the course, an aptitude test, such as the General Aptitude Test Battery, should be administered. Other tests in the profile should include an interest test, an achievement test, an occupational inventory, and a values test. With interest and aptitude test patterns identified and correlated with values, and then studied in light of achievement scores, educational planning could then be undertaken with students.

6. The same achievement test should be administered again just prior to graduation for evaluative purposes involving the whole program.

7. Counselors should strive toward an effective, interpersonal relationship with students to motivate self-referrals and student referrals.

8. Counselors and classroom teachers should be encouraged to work in conjunction with each other on some group guidance project to establish better rapport and understanding.

9. A placement service should be established or improved. This service should be concerned with the vocational guidance of the student in light of interpretation of test profiles, educational planning, course enrollment, progress in courses, job-hunting assistance, and on-the-job success as well as evaluation.

10. An effective drop-out study to reduce the number of students who leave school prior to graduation should be made. This should stimulate constant re-evaluation of the guidance program.

Microfilm \$2.75; Xerox \$9.00. 198 pages.

A CONCURRENT VALIDITY STUDY OF THE VOCATIONAL VALUES INVENTORY

(L. C. Card No. Mic 60-6970)

Jacob Stein, Ph.D.

Michigan State University, 1960

Major Professor: Gregory A. Miller

Three null hypotheses were advanced relative to the purpose of the study. They were:

1. There are no significant differences in the mean subtest scores of the Vocational Values Inventory among students planning to enter different occupations.

2. There are no significant differences in the mean subtest scores of the Vocational Values Inventory among students coming from different socio-economic levels.

3. There are no significant differences in the mean subtest scores of the Vocational Values Inventory among male and female students.

The subjects selected for this investigation were 436 students, 175 women and 261 men. They were enrolled in the Basic College at Michigan State University during the Spring Term of 1959.

The instruments used in the study were the Vocational Values Inventory and a specially designed questionnaire. The Vocational Values Inventory consists of seven subtests of 12 paired items each, or a total of 84 items. The subtests are as follows: Altruism, Control, Job-Freedom, Money, Prestige, Security, and Self-Realization.

Reliability for the instrument was tested in several ways. Using Hoyt's method of analysis of variance, reliability coefficients were obtained from the subtests that ranged from .69 to .91. The mean of the reliability coefficients was .82.

The technique of item analysis using Adkin's short form was used to identify items which might not contribute to the total score of the subtests. Among the men, 6 items were found which did not measure the property for which it was designed, while among the women, 14 such items were found.

The differences among the various groups, occupational, socio-economic, and male and female, were tested by the analysis of variance method. Duncan's technique was used to determine which means actually differed.

The Vocational Values Inventory was found to be reliable insofar as the limitations of this study is concerned. Similar results should be obtained in a retest of the same population.

Among the men, Altruism, Money, and Control significantly differentiated the stated occupational selections, and among the women, Altruism, Prestige, and Control performed the same function.

Ginzberg's theory of "Crystallization" appears to hold up for the men, but not for the women. The reality-based occupational selections of the men are fairly congruent, but they are not congruent for the women.

Except for the subtest of Money for the upper class men and Prestige for the upper class women, students from different socio-economic levels tend to achieve similar scores on the Vocational Values Inventory.

It appears that there is a relationship between values and vocational choice. This is not true for all the values of the Vocational Values Inventory, but only for Altruism, Money, Control, and Prestige. Men and women have

different values as measured by the Vocational Values Inventory and students coming from different socio-economic levels tend to have similar values or scores on the subtests of the Vocational Values Inventory. Thus, reinforced by the findings of congruence in fantasy and reality-based vocational selections for the men and none for the women, the above findings of value differences for men and women seem to indicate a need for separate tests for men and women. Microfilm \$2.75; Xerox \$8.20. 177 pages.

THE RELATIONSHIP OF SCHOOL ENTRANCE
AGE TO SOCIOMETRIC STATUS, MENTAL
HEALTH, AND SCHOOL ATTITUDES IN
INTELLECTUALLY SUPERIOR CHILDREN.

(L. C. Card No. Mic 60-6167)

Elizabeth Hendon Stokes, Ed.D.
North Texas State College, 1960

The primary purpose of this study was to determine the relationship of school entrance age to the sociometric status, mental health, and attitudes toward school in a selected sample of intellectually superior fifth and sixth grade students. A secondary purpose was to determine the relationship of different levels of measured intelligence on the sociometric status and mental health in a selected sample of sixth grade children who entered school prior to their sixth birthday.

The samples were composed of students selected from fifty-eight fifth and sixth grade classes from six school systems in two states. Efforts were made to assure homogeneity of the samples. All students in the participating classes were given the Large-Thorndike Intelligence Test, How I Feel Toward Others sociometric scale, Mental Health Analysis, and an attitude scale constructed by the investigator.

A minimum I. Q. score of 116 was necessary for inclusion in the intellectually superior sample. Four groups of intellectually superior children were selected for comparative purposes: underage sixth graders, overage fifth graders, normal-age fifth graders, and normal-age sixth graders. The overage and underage children had birth dates between September 1 and December 31, 1948, but the underage children entered school a year earlier because of the later chronological age requirement for school entrance in the state in which they resided. The normal-age children had birth dates between March 1 and June 30, each group being of normal age for the grade in which they were enrolled. Differences in the mean mental health scores and in the mean sociometric scores were tested by analysis of variance. Chi square was used to test the relationship between age at school entrance and attitude toward school.

The underage sample was composed of all the tested sixth grade children who were underage as defined above. The students were classified into three intellectual levels. Students with I. Q. scores of 116 or above were designated as above-average; those between 100 and 115 as average; and those below 100 as below-average. Differences in the mean mental health scores and in the mean sociometric scores among the three groups were tested by analysis of variance.

The analysis of the test scores of the underage groups indicated that the children of above-averaged measured intelligence differed in sociometric status and mental health scores from children with average and below-average intelligence. In both areas the scores of the children of above-average intelligence indicated significantly better adjustment.

The analysis of the test results of the intellectually superior groups revealed no significant differences in the mean sociometric or mental health scores of the groups who entered school at different ages. Only one item on the attitude scale indicated a relationship between school entrance age and attitudes toward school. It was concluded that the sociometric status, mental health, or attitudes toward school of the intellectually superior children were not affected by their school entrance age.

Since underage children of above-average intelligence were significantly better adjusted in mental health and social acceptance than underage children of lower intelligence, the implications are that readiness for school entrance should include other criteria in addition to chronological age. Since intellectually superior children who were underage were not penalized in the areas studied, the policy of a flexible school entrance age may be considered as one feasible method of meeting the educational needs of intellectually superior children.

Microfilm \$2.75; Xerox \$5.60. 113 pages.

A COMPARATIVE EVALUATION OF
THE WECHSLER-BELLEVUE SCALE
PERFORMANCE OF SELECTED
BRAIN-INJURED AND NON-INJURED SUBJECTS

(L. C. Card No. Mic 60-6072)

Newton Wayne Wiggins, Ed.D.
Indiana University, 1960

Chairman: Louis G. Schmidt

Problem

An attempt was made to determine whether differences in Wechsler-Bellevue test performance of selected groups of institutionalized, mentally subnormal subjects might be due to their differing etiology and/or to the interaction effect of diagnostic grouping and the subjects' age, length of hospitalization, length of illness and amount of formal schooling.

Procedure

The following steps were taken in carrying out the design of this investigation.

1. A group of 15 patients with lesions in the left hemisphere, a second group of 15 patients with lesions in the right hemisphere, a third group of 15 patients with diffuse brain damage, and a control group of 15 non-damaged patients were selected from the New Castle State Hospital, New Castle, Indiana. The hemisphere involved in each case was verified by psychological (Halstead Battery) and neurological (EEG) examination. The neurological examination and diagnostic procedures were completely

independent of the psychological testing, both with respect to the examiners involved and techniques used.

2. The Wechsler-Bellevue Scale (Form I) scores were obtained for each person before the groups were composed.

3. Complete information, including age, amount of formal schooling, length of hospitalization, and length of illness was obtained from each patient's medical record.

4. Means and standard deviations of the Wechsler-Bellevue Verbal, Performance, and Total weighted scores were calculated, and differences between group means were compared statistically through the use of Student's "t" technique.

5. The two-way classification of analysis of variance technique was utilized to test the influence of age, length of hospitalization, length of illness, and amount of formal schooling on intellectual functioning.

Findings and Conclusions

By comparing the mean weighted scores achieved by the four diagnostic groups of institutionalized brain-injured and non-injured subjects on the Verbal, Performance, and Total scales of the Wechsler-Bellevue Scale, it was shown that subjects with no brain damage scored significantly higher on the Verbal and Total scales than did subjects with any type of brain damage. The subjects with no brain damage did not, however, achieve scores significantly different from the right and left hemisphere damaged groups on the Performance scale. Subjects with diffuse brain damage achieved scores significantly lower than the right and left hemisphere and non-damaged groups on the Performance and Total scales, but there were no significant differences between the diffuse and left hemisphere damaged groups on the Verbal scale. There were no significant differences between the right and left hemisphere damaged groups on any of the three Wechsler-Bellevue scales. The postulate was advanced that since the brain damaged, mentally subnormal differed from the non-damaged, varied curricula would be necessary for the endogenous and exogenous individual.

The results also indicated that there were significant interaction effects on the Verbal, Performance, and Total scales of the Wechsler-Bellevue when the scores were classified according to diagnostic group and age, length of hospitalization, and amount of formal schooling, but not by length of illness. The hypothesis was stated that it was not sufficient to classify the mentally subnormal by neurological and psychological diagnosis, but that information such as age, length of hospitalization and amount of formal schooling are important variables which must be considered in developing curriculum procedures.

Microfilm \$2.75; Xerox \$5.40. 107 pages.

EDUCATION, RELIGION

SOCIAL RELATIONSHIPS OF ELEMENTARY SCHOOL CHILDREN AND THE RELEASED-TIME RELIGIOUS EDUCATION PROGRAM

(L. C. Card No. Mic 60-6702)

Gertrude Beatty Corcoran, Ed.D.
Stanford University, 1960

Purpose of the Investigation

This study examined the social relationships of children in schools which participate in the released-time religious education program. Sociometric measures were used to identify the social correlates of released-time participation and non-participation in public school classrooms from which children may be dismissed to attend the program.

Procedure

Two groups of sixty-four children each, matched by age, race, sex, IQ, socio-economic status, and religious background, were sampled from five hundred fifty-nine sixth-grade pupils in the Alum Rock Union School District. These two groups were categorized into: (a) Participants, comprising sixth-grade pupils who attended released-time classes for at least six months; (b) Non-Participants, comprising sixth-grade pupils who had not attended the released-time program.

The Columbia Classroom Social Distance Scale, the Moreno Sociometric Technique, and the Questionnaire for Public School Teachers were used to answer the following questions:

- (1) Do participants and non-participants of the released-time religious education program, matched according to race, age, sex, IQ score, religious background, and socio-economic status, differ in degree to which they are accorded social acceptance in their classroom group?
- (2) Are social acceptance scores of participants and non-participants associated with the proportion of children in their classrooms who attend the released-time religious education program?
- (3) Is released-time participation and non-participation related to the religious sub-group structure of the public school classroom?
- (4) Is there any association between teacher's attitudes toward the released-time program and their attitudes toward the children in their classrooms?
- (5) Is there any relationship between the teacher's attitude toward released-time religious education and the degree of pupil participation in the program?

Results and Conclusions

In classrooms which dismissed children to attend released-time religious education classes, participants did not receive social acceptance scores significantly different from those of non-participants. In addition, no significant relationship was found between the social acceptance of children and the number of their classmates who attended released-time classes. This study further demonstrated a lack of association between released-time participation and religious sub-group structure in public school

classrooms. Therefore, in terms of the population sampled and definition of social acceptance used, degree of participation in the released-time program was not demonstrably related to the sociometric status of elementary school children.

Teachers who favored and teachers who opposed the released-time program gave approximately the same proportion of good-citizen ratings to participants and non-participants. Teachers who favored and teachers who opposed the program also gave poor-citizen ratings in similar proportions to participants and non-participants. Thus we can conclude that no significant relationship existed between the attitudes of teachers toward the released-time program and the citizenship ratings which they gave to participants and non-participants in their classrooms. In addition, no significant difference was found between the proportion of children who attended released-time religious education from classrooms of teachers who favored the program and from classrooms of teachers who opposed it.

Microfilm \$2.75; Xerox \$6.20. 126 pages.

THE APPROPRIATENESS OF TEACHING CERTAIN RELIGIOUS CONCEPTS TO CHILDREN BETWEEN THE AGES OF SIX AND TWELVE

(L. C. Card No. Mic 60-6161)

James Harris Daniel, Ed.D.
North Texas State College, 1960

The problem of this study was to determine the appropriateness of presenting the concepts contained in the "Objectives of Christian Teaching and Training," of the Baptist Sunday School Board to children aged six through twelve. This study suggested the following hypothesis: Certain religious concepts are presented before the child has reached the maturity level to understand and use these concepts.

An intensive study of the objectives of teaching and training, primary and junior sections, was made to ascertain the aims of religious education for children aged six through twelve. From this study, concept clusters were derived that were to be taught by Southern Baptists to children aged six through twelve. Statements concerning the expected levels of understanding were derived from these objectives. In order to obtain some validity for the derived concept clusters, the concept clusters, along with the statements of the expected level of understanding, were presented to the members of the age-group subcommittees of the curriculum committee of the Baptist Sunday School Board for evaluation. The subcommittees were responsible for writing the primary and junior sections of "The Objectives." The responses of the subcommittees to the concept clusters and the statement of expected levels of understanding were carefully studied. Concept clusters and statements which were agreed upon by all reporting committee members were used.

The concept clusters and the statement of expected level of understanding were grouped according to two major headings, social and theological concepts. The social concepts were divided into concept clusters of moral judgment, home and family, self and others. The theolog-

ical concepts were divided into concept clusters of God, Jesus, Bible, church, conversion, prayer and Baptist denomination.

An intensive study was made of the literature in the area of concept development. The major findings as they relate to religious concept development were indicated. An intensive investigation was made of the available research related to the development of religious concepts in children, as reported in the major reference sources in child development and related fields. A brief summary was made of each relevant research study. A comparison was made between the research findings and the individual statements of the expected level of understanding.

The comparison of the research finding with the statements of expected levels of understanding revealed that a large number of the expectations were above the ability of most primaries and juniors. Of the one hundred thirty statements concerning the expected level of understanding, thirty-seven probably could be understood by the primaries or juniors and seventy-five probably could not be understood by the primaries or juniors. Eighteen of the statements needed additional study before an adequate conclusion could be reached. Each of the individual statements presented the level of understanding that could be expected.

The major conclusions reached indicated that a larger number of the social concepts than theological concepts could be understood by the primary or junior. The social concepts could be understood provided the adult gave specific suggestions for behavior. The primary and younger junior follow the suggestions of parents because they were expected to do this, but with little understanding concerning the reason for doing so. The older junior was beginning to learn to control many of his actions based upon inner controls.

The primary does not understand many of the theological concept clusters found in "The Objectives." Before the child can understand most theological concepts, he must be able to understand abstract concepts. The older junior is beginning to understand some of the abstractions in theological concepts, but it appears that adequate understanding of the concepts could not be obtained until the adolescent years. The primary and younger junior can use theological concepts on the verbal level, but does not understand what he is saying. Much research is needed in the field of development of religious concepts in children. Recommendations and suggestions for additional research were indicated.

Microfilm \$6.05; Xerox \$21.40. 474 pages.

AN ANALYSIS OF THE PROBLEM OF INTEGRATION IN THE CURRICULUM OF THE THEOLOGICAL SEMINARY

(L. C. Card No. Mic 61-303)

Charles Clarence Manker, Jr., Ph.D.
University of Kentucky, 1956

Director: Dr. Herbert Sorenson

Formal training for the Protestant ministry in America began with the founding of Harvard College in 1636. Before

the Great Awakening, only two other schools, William and Mary and Yale, had taken up this work. During the closing years of the eighteenth century the theological seminary was formed and by the end of the first quarter of the nineteenth century many of the leading seminaries of the present day were in operation.

The beginning of the twentieth century brought many changes in the seminary, among these a great expansion of the curriculum and the beginnings of cooperative, interdenominational study. In 1918 the first cooperative venture was begun in the formation of the Conference of Theological Seminaries which became the American Association of Theological Schools in 1936 and the recognized accrediting body for Protestant seminaries in 1938.

The cooperative movement in seminary education resulted in three interdenominational and nation-wide studies, each of which pointed up the problem of integration in the seminary curriculum as a major issue in theological education.

This same problem had confronted public school educators during the early decades of the twentieth century and a number of significant approaches were developed in an attempt to solve the problem. A basic assumption of this study is that these various approaches contribute toward the formation of a concept of integration by which the seminary may evaluate its integrative efforts.

The resultant concept is that integration is a dynamic process which involves a search for common denominator concepts, a study of purposes, a continuous investigation of the theory of values and the theory of knowledge which are basic to the educational institution, the development of a methodology, the conceptualization of facts, the organization of facts, and guidance, all in a continuous process.

A study of integrative practices which seminaries have developed in an attempt to solve the problem of integration in the curriculum involves a study of seminary catalogues, investigation of the literature on the theological curriculum, and personal conferences and correspondence with the presidents, academic deans, or chairmen of curriculum committees of seminaries. This study has restricted itself to a consideration of those seminaries accredited by the American Association of Theological Schools as of the 1954 biennial meeting.

The findings of this study indicate that the seminary has been devoting considerable effort and energy to the integrative problem in the curriculum ever since the release of the findings of the 1934 study. Seminaries have utilized the following practices to alleviate the integrative problem:

statement of purpose in such a way that both faculty and students are continuously aware of objectives of seminary education;

development of a core curriculum based upon the knowledge and skill necessary for success in the ministry;

reorganization of curriculum into broad fields emphasizing the interrelatedness of bodies of knowledge;

field work to integrate the theoretical with the practical;

orientation programs to help students see the basic oneness of the task of the seminary;

guidance programs through which students are helped to integrate all their learnings;

a functional library under the direction of a competent librarian who works closely with students and other faculty members;

several professors working together in one course;

completely prescribed curricula;

fusing academic and practical work;

senior comprehensive examinations;

closer faculty fellowship and understanding;

thesis which relates various bodies of knowledge.

This study concludes that seminaries have made great progress in overcoming fragmentation and isolation in the curriculum, but much more effort and experimentation is needed. Perkins School of Theology and the United Theological Seminary seem to have led the way in experimental ventures in an effort to integrate the curriculum.

Microfilm \$3.45; Xerox \$12.15. 267 pages.

EDUCATION, TEACHER TRAINING

A CRITICAL ANALYSIS OF PROGRAMS FOR JUNIOR HIGH SCHOOL TEACHERS IN TEACHER EDUCATION INSTITUTIONS OF THE UNITED STATES

(L. C. Card No. Mic 60-5215)

Ralph E. Ackerman, Ph.D.
The University of Connecticut, 1960

In this study, the problem was to make a critical analysis of the curricula for the preparation of junior high school teachers in institutions accredited by the National Council for Accreditation of Teacher Education. The procedure consisted of the following four steps.

Step I. A tentative statement of areas of preparation considered essential for junior high school teachers was developed. The literature on teacher preparation was carefully studied in order to ascertain these areas.

Step II. This tentative statement was developed into an opinionnaire which was submitted for evaluation to a group of 313 selected educators. Evaluations were received from 209 educators, eighty-five of whom were junior high school administrators, ninety-one college professors of education, and thirty-three were state certification officers. The criticism and evaluation by these leaders served to develop the final statement of areas of preparation which later was used as a basis for analyzing the curricula of the thirty-six institutions.

Step III. The present practices for the education of junior high school teachers were studied from an examination of catalogues of 246 institutions accredited by the National Council for Accreditation of Teacher Education. These 246 institutions were classified in several ways. Forty-six institutions did not indicate in their catalogues that they provide special facilities for the preparation of junior high school teachers. Of the other 200 institutions, 164 provide separate courses and thirty-six provide special curricula for the preparation of junior high school

teachers. These thirty-six institutions were divided into two groups: one consisted of twenty-eight institutions with a four-year junior high school program, and the other of eight institutions with a fifth-year program.

The junior high school programs in the thirty-six institutions which have a special curriculum were analyzed to ascertain the number of semester hours required for graduation and the courses that are required in general and professional education. The course offerings of these institutions were also analyzed to locate any elective courses that would be of direct benefit to students preparing to teach in the junior high school.

Step IV. The programs of the thirty-six institutions which provide a special curriculum for the preparation of junior high school teachers were analyzed in terms of the areas of preparation considered essential for junior high school teachers developed in Step II.

Conclusions

1. Relatively few institutions give as much attention to the preparation of junior high school teachers as to elementary and general secondary teachers.
2. There is considerable agreement among the educators in this study on the areas of preparation considered essential for junior high school teachers.
3. The educators are almost unanimous in their view that an understanding of the junior high school child is essential in the training program.
4. An understanding of the administrative functions of the junior high school was considered desirable, but not essential, for junior high school teachers.
5. There appears to be a lack of development of an understanding of the social, personal, and family relationships.
6. There is little attempt to interrelate various fields of knowledge included in general education. The only areas of preparation which appear to be interrelated are in professional education.
7. Most of the institutions require more than 70 per cent of the total program in the area of general education and subject matter preparation.
8. Most of the special junior high school curricula are modifications of the curricula for elementary or general secondary teachers.
9. Many of the institutions prepare junior high school teachers in the elementary or general secondary school curricula.

Microfilm \$3.40; Xerox \$11.95. 261 pages.

A PREDICTIVE DEVICE DESIGNED TO SELECT COOPERATING TEACHERS FOR THE ELEMENTARY STUDENT TEACHING PROGRAM AT THE PENNSYLVANIA STATE UNIVERSITY

(L. C. Card No. Mic 61-28)

William Harold Beisel, Jr., Ed.D.
The Pennsylvania State University, 1960

The ultimate quality of an off-campus student teaching program in elementary education rests primarily upon the effectiveness of the work of the cooperating teacher with the student teacher. It has been emphasized in this study that the selection of prospective cooperating teachers should be based upon professionally significant criteria. The purpose of this investigation was to develop a predictive device which would aid in the selection of cooperating teachers in the off-campus elementary student teaching centers.

A 50-item check list of important characteristics and functions of cooperating teachers was constructed and evaluated by a jury of professional educators. The validity criterion was established by securing a general evaluation of "excellent," "good," and "fair" by college coordinators for 145 cooperating teachers in nine student teaching centers. To test the effectiveness of the predictive device, four independent evaluations were completed for each cooperating teacher. Analyses were made between the college coordinator evaluations and the rank order established for the cooperating teachers, utilizing the predictive device.

The assumption was made that the development and utilization of a predictive device for selecting new cooperating teachers, based upon professionally significant criteria, could improve the quality of the student teaching program. The following findings and conclusions support this assumption.

1. Ninety-two per cent of the jurors responded to the 50-item check list and conclusively identified 34 characteristics and functions of cooperating teachers. These items formed the basic criteria for the predictive device.

2. A total effectiveness score for each cooperating teacher was determined and these scores were arranged from high to low by centers. The rank order of effectiveness scores for the nine centers placed each teacher in a definite position on the distribution.

3. The college coordinators rated 31 cooperating teachers "excellent," 94 "good," and 20 "fair." These data established the validity criterion which was used in validating the predictive device.

4a. Nine tables were constructed to show the comparison between the rank order of each cooperating teacher as determined by the predictive device, and the general evaluation of the college coordinators. A near perfect distribution was found in three centers. Cooperating teachers who were rated high by the four independent evaluators utilizing the predictive device were also rated high by the college coordinators. Teachers rated fair were at the bottom of the distribution. The observed relations for all nine centers was positive.

4b. The upper 25 per cent of the distribution found 17 of the 31 "excellent" cooperating teachers. In the upper 50 per cent there were 27. The lower 25 per cent of the distribution found 13 of the 20 "fair" cooperating teachers. In the lower 50 per cent there were 18.

4c. A statistically significant difference was found between the means of the scores of the cooperating teachers rated "excellent" by the college coordinators and the teachers rated "fair." A t_{h-1} ratio of 3.6344 was determined, which is significant at the .005 level. Teachers rated "excellent" had a significantly higher mean than did teachers rated "fair."

4d. An analysis of the distribution of the effectiveness scores, in standard score form (Z), and evaluations by college coordinators for 145 cooperating teachers was determined. An examination of the mean scores for each distribution revealed a positive correlation. A serial correlation of .39 using the Jaspens technique was computed for these data which is significant at the 1 per cent level.

4e. The reliability of the predictive device was computed in two ways. The application of Kuder-Richardson formula 21 revealed a reliability of .69 which is not as high as might be desired. An analysis of variance concept was employed to produce an estimate of reliability. Based on a sample of items, a reliability of .82 was obtained which may be reasonable or optimistic, but tends to support the Kuder-Richardson value of .69.

Microfilm \$2.75; Xerox \$5.00. 97 pages.

**MANIPULATIVE OPERATIONS AND
ELECTRONIC EQUIPMENT NEEDED IN
INDUSTRIAL TEACHER EDUCATION
BASED ON INDUSTRIAL PRACTICES**

(L. C. Card No. Mic 60-6783)

George Jackson Brown, Ed.D.
University of Missouri, 1960

Supervisor: H. H. London

PURPOSE: To ascertain what manipulative operations the electrical worker should be able to perform in the areas of electricity and electronics, to find out what type and size of electronic equipment is needed for this purpose, and to compare the above mentioned manipulative operations and equipment with operations taught and equipment used in industrial teacher education.

METHOD OF RESEARCH: Data for the study were secured through information forms obtained from representatives of 65 electronics manufacturing industries, 46 repairmen and technicians employed in servicing electronics equipment and devices, and from 70 college instructors who teach in industrial teacher education departments offering two or more courses in electricity and electronics.

SUMMARY: Operations involving the measurement of voltage, current, resistance, capacitance, wattage, impedance, inductance, frequency, and decibels were performed frequently by electronics production workers and repairmen.

Alignment and adjustment operations related to television, both monocolored and colored, were seldom performed by production workers. On the other hand,

repairmen performed these operations to a somewhat greater extent, but neither production workers nor repairmen indicated a high frequency of performance.

Operations which were associated with high frequencies and related applications were often indicated as performed by production workers and repairmen.

Production workers and to some extent repairmen tended to perform operations involving direct current more frequently than operations related to alternating current.

The servicing technique of substituting new parts for defective parts without a test or check was frequently employed by respondents.

The three most frequently performed checks made by production workers and repairmen included checks for loose connections, open resistors, and shorted capacitors.

The oscilloscope was the most frequently indicated piece of electronic test equipment used for operations performed by electronics production workers and repairmen. Of the 151 operations rated by production workers and repairmen in terms of equipment used to perform the operations, 73 were performed with the oscilloscope, as was indicated by the item of equipment found most frequently to be first choice.

The V.T.V.M. (vacuum tube voltmeter) was the second most frequently used piece of electronic test equipment. This was apparent in 32 operations of the 151 for which the V.T.V.M. was specified as first choice.

Fifty-nine operations out of the 151 operations rated by college respondents were not included in courses taught as frequently as the operations occurred in work performed by electronics production workers and repairmen.

The two groups of operations included in the block of measurements and those included in the block of tests and checks generally occurred more frequently in courses taught than performed by production workers and repairmen.

Sizes of equipment needed to perform the operations differed only slightly from that needed by production workers and repairmen.

CONCLUSIONS: The service manuals and books reviewed for manipulative operations found in this study would seem to be rather inappropriate as textbooks in courses designed for prospective industrial arts teachers.

There seems to be few differences in the sizes or types of equipment used in electronics manufacturing and that used in electronics servicing, but in the main they are much the same.

In contrast with industrial practices, electrical courses offered in industrial education departments for prospective teachers tend to include manipulative operations which are limited chiefly to electricity.

There appears to be a rather close agreement between the extent to which various operations occurred in work performed by electronics production workers and repairmen, and the extent to which the same operations are found in courses taught by college respondents.

Types and sizes of electronic test equipment used by electronics production workers and repairmen

appears to resemble closely the types and sizes used in courses taught by college respondents.

Microfilm \$2.85; Xerox \$9.90. 219 pages.

SELECTED TEACHERS' EXPRESSED JUDGMENTS CONCERNING BARRIERS TO CURRICULUM IMPROVEMENT

(L. C. Card No. Mic 60-6663)

Donald Frederick Cay, Ed.D.
The University of Florida, 1960

The problem of this study was concerned with an investigation of the expressed judgments of selected classroom teachers, in grades 8-12, relative to situations involving administrators, pupils, other faculty members, and parents, which seem to the teachers to present barriers to curriculum improvement.

Three instruments were used to collect data in four selected high schools. The Curriculum Improvement Measure was used to assess readiness for curriculum change in each faculty. The Questionnaire and the Interview were used to collect teachers' expressed judgments concerning barriers to curriculum improvement arising from their relationships with principals, other teachers, pupils and parents.

None of the four schools was ready for curriculum improvement, according to the mean scores earned on the CIM. The Questionnaire was divided into four areas of professional relationships and an area score ascertained for each area. All four schools chose the area of teacher-parent relationships as the area containing the most barriers to curriculum improvement. Schools A, B, and D rated the teacher-pupil area second most frequently as causing barriers. School C rated the teacher-teacher area second most frequently. In Schools B and D, the teacher-principal area was rated third most frequently and teacher-teacher relationships least frequently. In School A, the teacher-teacher area was rated third most frequently and teacher-principal relationships least frequently. In School C, teacher-pupil relationships were rated third most frequently and teacher-principal relationships least frequently.

A detailed item analysis was made of the items on the Questionnaire which were rated as barriers to curriculum improvement by 20 percent or more of the teachers in the sample. On an over-all basis, the rank order of areas containing barriers was: teacher-parent, teacher-pupil, teacher-teacher, and teacher-principal. Interview returns substantiated the responses to Questionnaire items by teachers. Ninety percent of the teachers in the Interview sample said the same things in reply to similar questions as they had indicated by their ratings of Questionnaire items.

From the data presented in this study, the following conclusions were drawn.

1. Strong indications were given by the teachers, in the data returned, that factors which they see as barriers to curriculum improvement can be isolated in the four areas of relationships investigated in this study.

2. In order to feel encouraged to participate in curriculum improvement activities, teachers need to know the following things:

- a. That they are included by principals in planning and policy-making decisions which affect school operation.
- b. That principals will consult them before making arbitrary decisions which affect daily school routine.
- c. That other faculty members are supportive of curriculum change.
- d. That they are accepted, both professionally and socially, by most other faculty members.
- e. That pupils are interested in sharing class planning and evaluation procedures.
- f. That they can see changed behavior patterns in the pupils they teach.
- g. That their goals and practices with pupils are similar to those of the parents.
- h. That parents will show interest in and support of the school program.

Microfilm \$3.35; Xerox \$11.70. 258 pages.

THE HISTORICAL-PHILOSOPHICAL BASES FOR TEACHER EDUCATION IN A BENEDICTINE COLLEGE

(L. C. Card No. Mic 60-6725)

Father Dunstan Ernest Frederick Curtis, O.S.B., Ph.D.
Stanford University, 1960

When St. Martin's College, Olympia, Washington, instituted a program in Teacher Education in 1957, considerable interest was shown, both within the staff of the institution and on the part of many persons outside, as to how this type of professional offering should become a part of the curriculum of a college of liberal arts and sciences. St. Martin's College is one of the educational enterprises carried on by the Roman Catholic monks of the Order of St. Benedict who comprise the religious community known as St. Martin's Abbey.

This dissertation consists of three sections, of which the first defines the Catholic and Benedictine philosophical-theological foundations which serve as the context for the educational apostolate at St. Martin's College. The second section presents the historical backgrounds for the adding of Teacher Education at this Benedictine institution. This portion of the study describes the history of the college as it grew out of its Benedictine context of 1400 years. At some length the author discusses the purposes of Benedictine monasticism and the place of education as one of the good works frequently performed by the members of the Order of St. Benedict. St. Martin's College was founded by St. John's Abbey of Collegeville, Minnesota, in 1895. The author traces the historical-educational development of the institution from this foundation through the four priors of St. Martin's Priory (1895-1914) and the three abbots of St. Martin's Abbey (1914-1960).

The historical section serves primarily as an illustration of the setting for the solution of the key problem posed by this dissertation, namely, why a Benedictine college of the sort represented by St. Martin's College has chosen to institute a program in Teacher Education for future teachers in the public schools of America. In other words, some philosophical justification has seemed necessary for the addition of such a professional program in view of the professedly liberal arts objectives of the college. By way of resolving this key problem, the author

compares several variant views concerning the objectives of liberal education. An "adaptive" position in regard to liberal arts goals is suggested as best agreeing with the adaptability of the Benedictine Order to the varying social context through which this order has passed since its founding in the sixth century. This "adaptive" position holds that practical and even professional studies can be admitted into the curriculum of a college of liberal arts and sciences without destroying the essential liberal content of the collegiate program.

The Order of St. Benedict in America has sensed the need to establish schools for young Americans which would not only educate them in the fullest traditions of classical and liberal education but would also prepare them for gainful employment in secular life. The fusion of these two purposes has been implied in the educational aims and objectives of every Benedictine college in America. The author explains how the present curriculum of a Benedictine college (taking St. Martin's College as the typical example) does in fact educate the student liberally. The threefold liberal arts core in a Catholic college, consisting of philosophy, theology, and language-literature, is shown to be present in the curriculum of St. Martin's College for all students, and specifically for candidates for the teaching profession. The staff at St. Martin's believes that the Teacher Education program at their institution is reasonably and adequately grounded in the liberal arts objectives and ideals of the college.

The dissertation closes with a consideration of the relationships, both as to similarities and contrasts, existing between St. Martin's College and other colleges and educational agencies in the State of Washington and in the nation as a whole. It explains how the Benedictines of St. Martin's College feel that they have an important contribution to make to American education.

Microfilm \$7.45; Xerox \$26.55. 586 pages.

FACTORS ASSOCIATED WITH SUCCESS IN FIRST GRADE TEACHING

(L. C. Card No. Mic 60-6547)

Margaret Seymour Gardner, Ph.D.
Northwestern University, 1960

The major problem of this study was to determine certain personal and professional characteristics of a group of first grade teachers by reference to their performances on objective tests and their responses to a questionnaire. A subsidiary problem was to make intragroup comparisons of the personal and professional characteristics of the teachers in three groups, designated as highly efficient, moderately efficient, and moderately inefficient. The group divisions were made after applying a composite criterion of efficiency which included an administrative rating, a rating by a second grade teacher, a self rating, and an objective rating by a qualified observer. Data were assembled by administering the Minnesota Teacher Attitude Inventory, the Wechsler Adult Intelligence Scale, the Edwards Personal Preference Schedule, and by obtaining teachers' responses to the three sections of the questionnaire. The questionnaire sought personal identification data, training and experience information, and facts concerning classroom practice and procedure.

Major Conclusions

The results of this study are in essential agreement with those of related investigations which suggest that no single test rating or factor yields a sufficiently high correlation with teacher efficiency to warrant its use as a single predictor of success in teaching. However, since the correlation coefficient between the MTAI and the efficiency criterion was +.52 and was significant at the .01 level, the results of this Inventory might be considered as one worthwhile means of predicting teacher success -- if such data were used with additional facts and information. Intragroup comparisons of MTAI scores revealed the superiority of the highly efficient teachers over the moderately inefficient teachers.

The relationship between the WAIS Full Scale scores and efficiency was expressed by a correlation coefficient of +.38, significant at the .05 level. The difference between the Full Scale mean scores of the highly efficient teacher and the moderately inefficient teacher was also accepted statistically. These data suggest that ability as measured by the WAIS will contribute positively to a combined criterion for predicting teacher efficiency.

The EPPS results showed that the total group of teachers scored significantly higher than the normative sample on the Achievement, Heterosexuality, and Dominance variables and significantly lower on the Order, Succorance, and Abasement variables. Intragroup comparisons revealed that the highly efficient teachers scored higher than the moderately inefficient teachers on the Autonomy and Deference variables and lower on the Aggression variable. The highly efficient teachers were more moderate in response than the other two groups of teachers.

Responses to the questionnaire indicated that efficiency was also positively related to marital adjustment, health status, level of training, years of teaching, size of class, and instructional flexibility in the classroom. Of all of the factors explored, the level of training and the number of course hours in the fields of psychology, guidance, and special education yielded the highest degree of relationship to the efficiency criterion. A correlation coefficient of +.61 was obtained between the efficiency criterion and the number of course hours of credit acquired in these specialized fields. That an increased level of training in the areas of child development and human relations is an important factor associated with success in teaching is suggested by the results of this study.

Various aspects of classroom procedures were explored. It was observed that as efficiency decreased, the teachers tended to be more insensitive to the needs of their pupils and were more inclined to be passive in their roles as initiators of effective learning activities.

Microfilm \$4.30; Xerox \$15.10. 333 pages.

FACTORS INFLUENCING ATTITUDINAL VARIATION AMONG CLASSROOM TEACHERS IN THE TEACHING OF MUSIC

(L. C. Card No. Mic 60-5230)

Ruth Phyllis Boak Gelineau, Ph.D.
The University of Connecticut, 1960

This investigation was prompted by concern over unfavorable attitudes which many elementary teachers entertain with regard to the teaching of music in the elementary classroom.

The investigator hopes to ascertain what factors are involved in the development of this attitude, and whether the attitudinal variation is attributable to certain environmental factors such as home or family or to training factors either in public schools or in teacher training experiences. The investigation resolves itself into a determination of the factors which are responsible for the positive attitude of liking to teach music and those factors which are responsible for the negative attitude of disliking to teach music.

The investigation was limited to regular teachers who were teaching in the elementary schools in two towns and one city in Connecticut and two towns and one city in New Hampshire. As part of a preliminary investigation, approximately forty interviews were held. Following this, 204 questionnaires were passed out to all the teachers in the aforementioned schools. These were administered by the investigator who visited each school for this purpose. Upon return of the 204 completed questionnaires to the investigator, they were separated into two groups -- those who like to teach music and those who dislike to teach music -- on the basis of answers given by respondents to two particular questions in the questionnaire. The results were then tabulated.

Results of the data appear to indicate the following conclusions:

1. A higher percentage of those who like to teach music had a greater proportion of musical experiences in elementary school, high school, and college than did those who dislike to teach music.
2. A higher percentage of those who like to teach music had a greater proportion of musical experiences during practice teaching than did those who dislike to teach music.
3. A significantly higher percentage of those who dislike to teach music indicated that they did not enjoy their early experiences in teaching music.
4. Both groups -- those who like to teach music and those who dislike to teach music -- indicated that in early teaching and practice teaching the music supervisor was the person who contributed more than any other to their musical goals.
5. Both groups -- those who like to teach music and those who dislike to teach music -- indicated that the principal was the person who contributed least to their musical goals.
6. The total history of vocal experience in the lives of those who like to teach music shows a higher percentage of participation in vocal activities than is shown in the lives of those who dislike to teach music.

7. Of those who dislike to teach music a significantly higher percentage indicated that they need a piano for teaching new songs but have none in their classrooms.
8. Of those who like to teach music the highest percentage have been teaching over twenty-five years.
9. Of those who like to teach music a preponderant majority had the greater part of their teaching experience on the primary level (kindergarten through third grade).
10. There is a consistent trend of higher percentage of musical exposure and experience in nearly all areas investigated for those who like to teach music than for those who dislike to teach music.

Microfilm \$2.75; Xerox \$6.40. 131 pages.

FACTORS THAT INFLUENCE THE EXCELLENCE OF SUPERVISING TEACHERS IN BUSINESS EDUCATION

(L. C. Card No. Mic 60-6051)

Helen Elizabeth Gibbons, Ed.D.
Indiana University, 1960

Chairman: Elvin S. Eyster

Problem

The problem is a study of the factors that influence the excellence of supervising teachers in business education.

Procedure

A modified case study approach was used in solving the problem. This involved personal interviews with 48 selected supervising teachers in business education who were an integral part of the student teaching programs of Ball State Teachers College (Muncie, Indiana), Indiana State Teachers College (Terre Haute, Indiana), and Indiana University during the 1958-59 school year. The teachers were selected by the directors of student teaching of each of the three institutions as being in the upper third of the entire group of supervising teachers employed by their institutions during the 1958-59 school year. Personal interviews were conducted also with 54 student teachers under the direction of the selected supervising teachers.

The data were concerned with general personal and professional characteristics and methods of operation of the supervising teachers. General personal and professional characteristics were interpreted to mean the teacher's philosophy of education and outlook on student teaching; attitudes toward professional education, toward teaching, and toward the student teaching experience; and personal background and interests. Methods of operation was the all-inclusive term used to refer to the procedures and practices employed by the supervising teachers in directing, teaching, and supervising student teachers.

Analysis of all data collected led to division of the supervising teachers into two groups: one, superior and the other, typical. The number in the former was 13; in the latter, 35.

Findings

Of the general personal and professional characteristics considered, outlook on student teaching was the one characteristic which differentiated the superior group from the typical group. The superior supervising teacher is superior because of his own belief that he has something worth while to contribute to the education of a prospective teacher. Believing this, he willingly assumes the role of supervising teacher in order to fulfill what he considers a professional obligation. This was evidenced by the opinions the superior supervising teachers expressed in regard to the student teaching program and by their willingness to supervise a student teacher. Their reasons for supervising student teachers--because of the personal satisfaction they received from working with a student teacher, because of the professional obligation they saw in supervising student teachers, because of the contact it made possible with the college, and because of the professional recognition afforded them in having been chosen as a supervising teacher--set them apart from the typical group.

Six distinguishing methods of operation had a positive influence on the excellence of the superior supervising teachers.

1. Good rapport was established by welcoming the student teachers warmly.
2. High school students were informed about and prepared psychologically for the coming of the student teacher.
3. Gradual introduction of the student teacher to teaching enabled him to learn before taking over the full responsibilities of teaching.
4. Constructive criticism of the student teacher's written lesson plans by the supervising teacher insured effective instruction and avoided embarrassment to the student teacher.
5. Intelligent observation and participation by the supervising teacher provided the basis for optimum supervisory activities with the student teacher.
6. Daily professional conferences with the student teachers provided the media for good supervision including individual instruction.

From further analysis of the characteristics and methods of operation of the 13 superior supervising teachers, a professional image of a superior supervising teacher in business education was discerned.

Microfilm \$2.75; Xerox \$6.20. 128 pages.

**A STUDY OF PROGRAMS OF
PRE-SERVICE AND IN-SERVICE EDUCATION
FOR COOPERATING SCHOOL SUPERVISING
TEACHERS USED BY SELECTED
TEACHER EDUCATION INSTITUTIONS**

(L. C. Card No. Mic 61-279)

Robert Bruce Hayes, Ed.D.
University of Kansas, 1960

1. Statement of the Problem. With the increased emphasis on student teaching and the use of the public schools to provide this experience, more persons have responsibilities for the supervision of the college students who are

enrolled in teacher education programs. To assure teacher education programs of the highest quality, the institutions responsible for the education of prospective teachers must select the best teachers available, and then provide an education which will assist them in their supervisory work. The writer could not find a study concerned directly with the preparation of the supervising teacher. In this investigation the writer examined selected programs of pre-service and in-service education for cooperating school supervising teachers to determine what was being done to prepare the beginning supervising teacher and to improve the work of the experienced supervising teacher.

2. Procedure. To secure the information for this study the writer made a visit to the campuses of ten teacher education institutions. An interview which was recorded on tape was conducted with a member or members of each faculty, and the information gathered by this method was supplemented by a study of literature provided by each institution for the supervising teachers.

3. Findings. The pre-service education programs were characterized by the following:

1. Six of the institutions offered a course designed to prepare the supervising teachers.
2. The individual conference between a college supervisor and a supervising teacher served as the major means of orientating the supervising teachers.
3. No organized attempt was made to acquaint the supervising teachers with teacher education.
4. Seven of the institutions used one or more means to acquaint the supervising teachers with professional organizations and publications.
5. The personal data sheet prepared by the students for the supervising teachers and the guide for supervising teachers prepared by the faculties were used to provide information concerning the teacher education curricula.
6. No direct attempt was made to acquaint the beginning supervising teachers with the faculties of the institutions.

The in-service education programs were characterized by the following:

1. In five of the institutions investigated there was a planned attempt to bring the supervising teachers and the student teachers together prior to the beginning of student teaching.
2. A student teacher personal data sheet was provided for supervising teachers by all but one institution.
3. Group conferences were utilized by each institution investigated.
4. The workshop approach was used by four of the institutions but on a regularly scheduled basis by only one of them.
5. The individual conference between a college supervisor and a supervising teacher was considered the most vital part of the in-service education program.
6. Printed materials which were prepared by

members of the faculties of the institutions as well as materials purchased by the institutions were distributed to supervising teachers.

7. In only two institutions was there a specified amount or plan for financing the in-service education programs.

4. **Conclusions.** (1) Very little had been done toward providing pre-service education for the supervising teachers. No specific course work was required for the supervising teacher and in most cases, the institutions relied upon an individual conference held by a college supervisor and a printed guide as the methods of aiding the beginning supervising teachers; (2) The in-service education programs were built around literature and conferences. The individual conference between the supervising teachers and the college supervisors was considered to be the most valuable method used, but group conferences offered an excellent means for providing in-service education. In some institutions numerous printed materials were provided for the teacher, but in most cases the development of this phase of the programs was hindered by a lack of a specified budget for this purpose and the large work load of the college supervisors.

Microfilm \$2.75; Xerox \$7.80. 169 pages.

AN EVALUATION OF THE EFFECTIVENESS OF TUSKEGEE INSTITUTE'S BASIC COURSE IN AUDIO-VISUAL EDUCATION WITH RECOMMENDATIONS FOR IMPROVEMENT

(L. C. Card No. Mic 60-6056)

Pearl Walker Headd, Ed.D.
Indiana University, 1960

Chairman: Carolyn Guss

The Problem

The problem of this study was to determine how the course, Introduction to Audio-Visual Education, offered at Tuskegee Institute from 1955 to 1959 could be improved. Questions concerning the content, its usefulness, relationship to similar courses, and deterrents which students may encounter were of special concern. The purposes of the study were to identify those experiences in the course which former students reported they found most helpful in actual teaching situations, and to derive conclusions, as warranted by the investigation, which would serve to strengthen the organization, content, and purposes of the basic course in audio-visual education at Tuskegee Institute in the professional preparation of teachers.

The Procedure

An extensive study of the literature was made for problems, findings, and conclusions on the subject of audio-visual methods in teacher education as they related to the attitudes, competencies, knowledges, skills, and understandings needed by elementary and secondary teachers. A screening questionnaire was constructed and sent to the

542 persons who had completed the course, Introduction to Audio-Visual Education, at Tuskegee Institute from 1955 to 1959. A second questionnaire designed to solicit evaluation of the adequacy of the basic course in audio-visual education at Tuskegee Institute and recommendations for improvement, was constructed and sent to the 260 elementary and secondary teachers, principals, and supervisors who had expressed willingness to participate further in the study. Two hundred twenty-five, or 86 per cent, of the questionnaires were returned, and 219 were usable. They were analyzed and conclusions were drawn.

Findings

Colleges and universities offered training in basic audio-visual education on both pre-service and in-service levels and emphasized the selection and utilization of audio-visual materials, the operation of equipment, and production of simple instructional materials. Some institutions offered a single basic course, some offered units of audio-visual instruction in their professional methods courses, and others used a combination of both methods.

A majority of the institutions offered two or three semester hours of credit for their basic audio-visual education courses.

Former students of the Tuskegee Institute course reported that techniques of selection and utilization of audio-visual materials and the operation of equipment were the most useful aspects of the course. Production of materials which were unavailable in the schools was reported as one of the least useful aspects of the course.

Conclusions

On the basis of the findings of this study the following conclusions were drawn: (1) The contents of basic audio-visual courses should include both the theoretical and applied aspects of audio-visual education; (2) both the lecture and laboratory methods are desirable; (3) adequate physical facilities, materials, and equipment should be provided to meet the course objectives, and (4) the course structure and content should reflect educational and social changes resulting from advances in technology, educational methodology, and curriculum organization.

Recommendations

Since five major subject-matter areas--science, social studies, language arts, mathematics, music and art--represent the areas of the greatest frequency of use reported by former students of the Tuskegee Institute course, it is recommended that examples and experiences used in the class be drawn primarily from these areas.

It is recommended that persons in charge of basic courses in audio-visual education so plan laboratory experiences as to give opportunity to students for learning to operate more than one model of basic equipment.

Systematic study concerning the nature and significance of the objectives, content, and learning experiences in a basic audio-visual education course should be continued.

Microfilm \$2.75; Xerox \$8.40. 184 pages.

**AN INVESTIGATION OF THE
FORCED-CHOICE TECHNIQUE AS
A PREDICTOR OF SUCCESS
IN STUDENT TEACHING**

(L. C. Card No. Mic 60-6989)

Donald Wilson Irvine, Ph.D.
The University of North Carolina, 1960

Supervisor: Dr. William D. Perry

The purposes of this study were: (1) to investigate the relationships between measures of student teachers' self-concepts and their success in student teaching; (2) to investigate the relationships between measures of student teachers' concepts of the ideal teacher and their success in student teaching; (3) to investigate the relationships of discrepancies between measures of student teachers' self-concepts and measures of their ideal-teacher concepts to success in student teaching; and (4) to attempt to develop a self-rating scale predictive of success in student teaching.

After reviewing the literature, the writer decided to utilize the forced-choice technique, through which student teachers would make ratings of themselves as teachers and would make ratings of what they believed the traits and behavior patterns of the ideal teacher to be. The criterion of student-teaching success used in the study was the mean ratings given student teachers by their two supervisors.

In May, 1958, 101 student teachers rated 226 phrases for desirability in a teacher. On the basis of this measure of "desirability" for each phrase, 191 pairs of phrases were devised by pairing phrases which were very nearly equal in "desirability." This preliminary scale was further refined and culminated in the final forced-choice scales administered before and after student teaching in the spring of 1959. Both "self-as-teacher" and "ideal-teacher" ratings were made.

Product-moment correlations between the four final forced-choice scales and the criterion ranged from +.13 to -.15. None of these correlations was significant at the .05 level of confidence. Two abbreviated scales were devised from one of the final scales, the most promising of which correlated +.21 with the criterion. This coefficient was significant at the .05 level of confidence. The test-retest reliability calculated for this scale was .41.

Conclusions

1. The forced-choice technique, as devised in this investigation, did not yield results which were highly predictive of student-teaching success, under either "self-as-teacher" or "ideal-teacher" instructions.
2. Discrepancies in marking the scales under two sets of instructions failed to provide a means of predicting success in student teaching.
3. The first abbreviated scale was found to be the most promising of the scales devised.
4. The first abbreviated scale is believed to be highly resistant to bias because:
 - A. the pairs of phrases were constructed by pairing phrases with essentially equal "desirability" ratings; and

B. there were presumably no opportunities for respondents to show individualistic patterns of responding.

5. The first abbreviated scale differs markedly in nature from other kinds of information available for predicting success in student teaching. Therefore, it appears likely that this scale would add considerably more to prediction than would another variable which is equally correlated with the criterion, but is also highly intercorrelated with other predictive variables.

Recommendations for further research included: (1) administration of the more promising scales under improved conditions, and revising scoring keys, if necessary; and (2) calculating a multiple correlation coefficient between the criterion and several other measures, including the proposed revised scale, scholastic aptitude test scores, grade-point average, and personality inventory data.

A multiple correlation study for the female student teachers was appended to the thesis. A multiple correlation coefficient of .44 was obtained, using the first abbreviated scale, scholastic aptitude scores, and grade-point average to predict the criterion (student-teacher ratings).

Microfilm \$2.75; Xerox \$6.40. 133 pages.

**RELATIONSHIPS BETWEEN CERTAIN
BACKGROUND FACTORS OF SELECTED
BUSINESS TEACHERS AND ATTITUDES TOWARD
TEACHING BASIC BUSINESS SUBJECTS**

(L. C. Card No. Mic 60-6670)

Raymond Lawrence Jones, Ed.D.
The University of Florida, 1960

A personal interview was conducted with sixty selected Florida business teachers to determine their opinions and reactions toward teaching high school business subjects. Certain background data regarding academic preparation for teaching, teaching experience, and work experience in business occupations were collected for each of the interviewed teachers. The background data were tabulated and analyzed in relation to the subject matter teaching preferences of the sixty teachers as revealed through a preference classification process based upon comments the teachers made during the interviews.

Findings

1. Thirty-four or 56.67 per cent of the sixty teachers had a strong preference or a moderate preference for teaching the skill subjects of business education. Nineteen or 31.67 per cent had a strong preference or a moderate preference for teaching the basic business subjects of business education. Seven or 11.66 per cent had no particular teaching preference.
2. The distribution of the sixty teachers among the five teaching preference classifications upon the basis of the skill-basic type and pattern of subject matter previously and currently taught was found to be highly significant.
3. The distribution of the sixty teachers among the five teaching preference classifications upon the basis of

the types of work experiences in business occupations was found to be highly significant.

4. The median number of college semester hours completed in skill subjects by the twenty-four teachers in the strong skill preference classification was 21.50 semester hours; in basic business subjects, 16 semester hours.

5. The median number of college semester hours completed in skill subjects by the nine teachers in the strong basic preference classification was 21 semester hours; in basic business subjects, 26.60 semester hours.

6. Teachers in all preference classifications except the no preference classification currently felt greater confidence in their qualification to teach basic business subjects than they felt at the time of receiving their undergraduate degrees.

7. The following factors are important considerations contributing to the attitudes the sixty teachers held toward teaching basic business subjects: (a) the status of basic business subjects in the high school; (b) the attitude of school administrators, other faculty members, and high school students toward basic business subjects; and (c) the caliber of students enrolled in basic business subjects.

Conclusions

1. Most high school business teachers prefer to teach the skill subjects of business education rather than the basic business subjects of business education.

2. Undergraduate programs of business teacher education place greater emphasis upon preparation for teaching skill subjects than upon preparation for teaching basic business subjects, and better prepare business teachers to teach skill subjects.

3. Business teachers who teach or who have taught basic business subjects have a more favorable attitude toward teaching basic business subjects than do teachers who do not teach or have not taught basic business subjects.

4. Business teachers who have engaged in or do engage in non-stenographic-clerical types of business occupations have a more favorable attitude toward teaching basic business subjects than do teachers who have engaged in or do engage in stenographic-clerical types of business occupations.

5. Factors other than subject matter preparation, teaching experience, and work experience in business occupations contribute in an important manner to the subject matter teaching preferences of high school business teachers. Microfilm \$2.75; Xerox \$8.60. 188 pages.

HOW YOUNG MEN IN MISSOURI COMMUNITIES SERVICED BY VOCATIONAL AGRICULTURE START AND PROGRESS IN FARMING

(L. C. Card No. Mic 60-6810)

Herschel T. Lester, Jr., Ed.D.
University of Missouri, 1960

Supervisor: Dr. G. F. Ekstrom

PURPOSE: The major purpose of this study was to determine the problems which young men in Missouri encounter in starting and progressing in farming.

METHOD OF RESEARCH: Data for the study were obtained through personal interviews with 100 young farmers located in four reorganized school districts north of the Missouri river. Certain specifications were designated for the population centers, and four districts were thereafter selected at random. Similarly, the 25 young men from each of the four districts were selected at random.

SUMMARY: The mean age of the 100 young farmers included in the study was 28.3 years. All of them started to farm between the years 1946 and 1957. At the time of the study the men were found to be in four different status classifications: father-son partnerships, share tenants, partners away from home, and owners or owner-renters. The father-son partnership was the most common status.

The pattern followed by most of the men in progressing toward establishment was that of the father-son partnership on a continuing basis. The next most common pattern involved departure from such partnerships to one or more intervening status classifications and subsequent return to partnerships.

The steps followed more generally by the men, in establishing farm businesses were father-son partnerships to share tenants to owners or owner-renters. However, it was not uncommon for the men to by-pass the status of share tenants and become land owners directly from father-son partnerships.

Upon entrance in farming the men had accumulated an average of 3200 dollars in starting assets. In acquiring assets they had saved money, accumulated livestock, machinery and equipment, and in some cases received gifts or inheritances. Also, 60 of the men had borrowed money.

Total income in 1959 for the 100 young men averaged 3700 dollars, and the farm income averaged 3200 dollars. The farm business assets averaged 40,000 dollars; the liabilities of the farm business averaged 7400 dollars, and the net worth was 33,000 dollars.

Banks were the major source of finances for the young men. Other sources included parents, friends and neighbors, and Production Credit Associations. The men had acquired 177 loans for an average of 8,700 dollars per person.

Major success factors in starting a farm business, in the opinions of the young farmers, were accessibility to the family farm, use of family owned equipment, educational assistance, and non-family credit.

The problems encountered by the men involved finances, acquiring livestock and obtaining land. They obtained relief from financial problems by borrowing money, working off the farm, and from earnings by their wives. Livestock problems were dealt with by treating diseased animals, and eliminating non-breeders and low producers. Land problems were resolved in part by arranging for partnerships with parents, renting land from relatives, friends and neighbors, and entering into partnerships away from home.

The men felt that they needed assistance in certain areas of farming. They ranked farm management, use of credit, marketing farm products, and farm mechanics as areas of major concern.

The educational assistance desired by the young men from vocational agriculture included instruction in evening classes, advice on farm problems, and on-farm visits.

Men with four years of vocational agriculture had higher farm assets, larger net worth, and more farm

income than those with less than four years of vocational agriculture.

Microfilm \$2.75; Xerox \$9.70. 212 pages.

RELATIONS BETWEEN COOPERATING
TEACHERS' AND STUDENT TEACHERS'
ATTITUDES AND PERFORMANCES

(L. C. Card No. Mic 60-6631)

Robert David Price, Ph.D.
The University of Texas, 1960

Supervisor: Dr. Henry J. Otto

The purpose of this investigation was to determine whether or not student teachers changed their pre-student teaching attitudes in the direction of the attitudes held by their cooperating teachers as a result of their student teaching experiences. The study was also designed to determine whether or not student teachers' assessed classroom teaching performances showed any significant correlation with the assessed classroom teaching performances of their respective cooperating teachers.

The population of the study consisted of forty-five selected elementary school student teachers from The University of Texas and their respective cooperating teachers from the Austin Public Schools. Selection of both the student teachers and their cooperating teachers was dependent upon their Minnesota Teacher Attitude (MTAI) scores. Study subjects were selected from the 100 prospective student teachers and the 116 prospective cooperating teachers who took the MTAI prior to the student teaching semester.

The fifteen student teachers who comprised the "high" group were selected from those who received the highest twenty pre-student teaching MTAI scores. The fifteen student teachers who comprised the "middle" group were selected from those who scored nearest the student teacher mean MTAI score. The fifteen student teachers who comprised the "low" group were selected from those who received the lowest pre-student teaching MTAI scores. The same procedure was used in the selection of cooperating teachers.

Each of the "high," "middle," and "low" groups of student teachers was randomly divided into three subgroups for a total of nine subgroups. Then, all possible combinations of high, middle, and low subgroups were arranged with high, middle, and low subgroups of cooperating teachers.

For purposes of the study the assignments of the forty-five selected student teachers were based upon: (1) student teachers' choices of grade levels, (2) grades available for student teaching, (3) student teachers' MTAI scores, and (4) cooperating teachers' MTAI scores.

Supervisors of student teachers from The University of Texas assessed the performances of both the cooperating teachers and the student teachers during their regular classroom visitations. The instrument used was Sanders' Observation Schedule. Cooperating teachers' performances were assessed during the first month of the student teaching semester while the student teachers were observing and assisting their cooperating teachers. Student

teachers' performances were assessed during the last month of their internships when they were teaching a full half day in their respective classrooms. The student teachers were retested with the MTAI during the last two weeks of the student teaching semester.

The hypotheses and conclusions of the study were:

Hypothesis One. The spread in student teachers' MTAI scores will be smaller on the retest than it was on the initial administration of the Inventory.

Conclusion. There was no significant difference in homogeneity between student teachers' initial and retest MTAI scores which were assessed prior to and at the termination of the student teaching semester. Hypothesis One was rejected.

Hypothesis Two. Student teachers' MTAI retest mean scores will change in the direction of the MTAI mean scores attained by their cooperating teachers.

Conclusion. On the basis of an analysis of variance and a non-statistical inspection of the nine subgroup score changes, it was accepted that student teachers' MTAI retest mean scores showed changes in the direction of their cooperating teachers' MTAI mean scores.

Hypothesis Three. Student teachers whose initial scores on the MTAI placed them in the lower or middle third of the selected group of student teachers will show greater score changes when the MTAI is repeated at the end of the semester than the student teachers whose initial scores were in the upper third.

Conclusion. Fisher's t-test of significance showed no significant score changes between student teachers' initial and retest MTAI scores. Hypothesis Three was rejected.

Hypothesis Four. The correlation between student teachers' initial MTAI scores and their Sanders' Observation Schedule scores will be lower than the correlation between their MTAI retest scores and their Sanders' Observation Schedule scores.

Conclusion. The z' scores between correlations of student teachers' initial attitudes and performances and their retest attitudes and performances were not significant. Hypothesis Four was rejected.

Hypothesis Five. There will be a significant positive correlation between student teachers' and cooperating teachers' scores on Sanders' Observation Schedule at the end of the student teaching semester.

Conclusion. Pearson's Product Moment Correlation Coefficient yielded an "r" between student teachers' and cooperating teachers' classroom performances which was significant at the .05 level of confidence. Hypothesis Five was accepted.

The general conclusions based upon this study indicated that the teaching performances of cooperating teachers have some influences upon the teaching performances of their student teachers. Very little is known about student teacher-cooperating teacher relations and it is strongly recommended that additional research be conducted in this area.

Microfilm \$2.75; Xerox \$6.00. 122 pages.

**A DESCRIPTIVE ANALYSIS OF THE
OFF CAMPUS STUDENT TEACHING PROGRAMS
OF THE ELEVEN TEACHERS COLLEGES OF
THE STATE UNIVERSITY OF NEW YORK IN
RELATION TO THE A.A.C.T.E. PRINCIPLES**

(L. C. Card No. Mic 60-5249)

Clinton John Roberts, Ph.D.
The University of Connecticut, 1960

STATEMENT OF THE PROBLEM

After a three-year study, the American Association of Colleges for Teacher Education in their 1948 Yearbook stated eight basic principles or "guide lines" regarding the nature and place of student teaching experiences in a functional program of teacher education. Using these eight basic principles as qualitative standards, an evaluation of the off campus student teaching programs of the eleven teachers colleges of the State University of New York was made.

METHODS USED

The eleven teachers colleges were visited and, through the use of a questionnaire, Directors of Education and other college staff were interviewed. In addition, all printed materials relating to the off campus student teaching program were collected.

Analysis of the data was made in terms of identifying the most promising practices, questionable practices, and least promising practices in relation to the eight principles.

RESULTS OF THE STUDY

I. All eleven colleges have in general a functioning, full time and continuing student teaching program. All students, however, are not given an off campus experience.

II. The eleven colleges have rigid curriculums in relation to time and place of student teaching in their program.

III. There are weaknesses in the administrative function in several of the colleges in the placement of student teachers.

IV. For varying reasons some colleges do not make available to their students in off campus centers, materials and supplies (including audio-visual aids).

V. The colleges fail generally to involve academic staff, other than Education Department members, in the student teaching programs.

VI. Only one college makes provisions for every student to visit the off campus center where he will do his student teaching prior to his student teaching experience.

VII. The selection and use of the off campus center and the cooperating teacher by some colleges is made with little or no investigation.

VIII. Orientation meetings prior to off campus student teaching assignments varied from a one or two hour session at one college to a three day session at another.

IX. Admission practices for student teaching lack thoroughness in reviewing students record.

X. Only two colleges have seminars occurring concomitantly with student teaching.

RECOMMENDATIONS

I. All students in the State University Teachers Colleges should be given a student teaching experience in an off campus center.

II. The curriculums of the colleges should be studied and revised so that "readiness to teach" would be the determining factor in assignment to student teaching. The length of time spent in student teaching should vary with the individual needs.

III. Every college should have a central office where a Coordinator of Student Teaching has all pertinent information available relating to the student and the off campus center. It should be his final responsibility to make assignments.

IV. It is strongly recommended that all materials and supplies (including audio-visual aids) be made available to the student teacher in an off campus center.

V. Efforts should be made to have student teaching regarded as an all college responsibility with direct involvement of any and all staff resources.

VI. It is recommended that all students visit the off campus center where they will teach prior to their actual period of student teaching.

VII. It should be the responsibility of the coordinator and other members of the staff to make a thorough investigation of the school and any potential cooperating teacher before their use.

VIII. Orientation meetings prior to off campus student teaching should be of sufficient length to help prepare students for the many and varied responsibilities of teaching.

IX. Provision should be made for a thorough study and review of each individual's record prior to admission to student teaching.

X. It is recommended that a seminar on problems relating to student teaching held concomitantly with student teaching be included in the curriculum of every college.

Microfilm \$2.75; Xerox \$7.40. 159 pages.

**AN ANALYSIS OF THE
ORAL LANGUAGE OF
THIRD GRADE CHILDREN**

(L. C. Card No. Mic 60-6066)

Ruby Friese Shubkagle, Ed.D.
Indiana University, 1960

Chairman: Ruth G. Strickland

Purpose

The purpose of this study was to analyze the oral language of third grade children as evidenced in situations devised to elicit as nearly spontaneous, non-directed conversation as possible and to ascertain the language patterns used by those children according to sex, intelligence and paternal occupation.

Collection of Data and Procedures

A sample of 100 third grade children was selected by

random sampling. Intelligence quotients were obtained from the California Test of Mental Maturity. The children were classified according to the Minnesota Scale for Paternal Occupations. Mechanical recordings were made of the conversations of each of the 100 children in the sample and an arbitrary selection of 25 consecutive verbal responses was made from the conversation of each child. The verbal responses were analyzed at two linguistic levels according to a scheme of analysis developed by a group of nationally known linguists, for a larger study conducted at Indiana University. The analysis at Level I revealed the language patterns by identifying the elements which maintain relatively permanent positions in an English sentence and the elements which change position. The analysis at Level II showed the types and amount of subordination used. The average frequency of occurrence of the language patterns and the various types of subordination was determined for the categories of sex, intelligence and occupational class.

Findings

A vast variety of language patterns was used by the third grade children in the sample. The patterns occurring most frequently represented the standard order of American English, e.g., subject, verb and direct object; subject, verb, indirect object; and subject, verb. All of the types of movable elements in American English considered in this study were used with great dexterity.

The children in the sample appeared to use all types of subordination. The subject-predicate group modifying a noun was used less frequently than other types.

Sex and paternal occupation seemed to have little influence upon the language patterns used by the children in the sample. The children with lowest intelligence used the simplest patterns and their patterns tended to occur in short sentences.

Conclusions

The spontaneous, nondirected oral language used by third grade children in the sample contained all of the types of syntactical elements found in American English according to the linguistic analysis applied to the study. Sex and paternal occupation appeared to have little influence upon the language of the children used in this study. Intelligence affected the variety of patterns used, the children with the lowest intelligence were the least skillful in manipulating the movable elements in the language.

Microfilm \$2.75; Xerox \$8.20. 176 pages.

AN APPRAISAL OF THE OPINIONS OF INDIANA SCHOOL EMPLOYING OFFICIALS CONCERNING THE PREPARATION OF SECONDARY TEACHERS

(L. C. Card No. Mic 60-6067)

Lucile Brackney Spencer, Ed.D.
Indiana University, 1960

Chairman: Howard T. Batchelder

This investigation involved an appraisal of school employing officials' opinions concerning the adequacy of

preparation of secondary teachers in Indiana colleges and universities today. Of all those interested in the schools no one group is in a better position to express informed opinions concerning the best kind and quality of preparation for teachers than the group who selects and employs them.

There were three major purposes in this study: (1) to determine the opinions of school employing officials in Indiana regarding the adequacy of certain aspects of secondary teacher education programs in Indiana colleges and universities; (2) to determine the suggestions of employing officials concerning the improvement of secondary teacher education programs in Indiana colleges and universities; and (3) to determine certain of the understandings, abilities, skills, knowledges, and personal qualities of secondary teachers that are considered most desirable by school employing officials.

Data for the study were collected by obtaining the opinions and suggestions of secondary school employing officials in Indiana for the school year 1957-1958. The procedure for collecting the data involved the preparation of a questionnaire which provided opportunity for the employing officials to express opinions and make suggestions.

A sampling was taken of four different classifications of secondary school employing officials; school board members, township trustees, superintendents in school corporations governed by school boards, and secondary school principals. The cluster sampling technique was used in selecting the school board members, superintendents, and principals to be sampled. The entire population of township trustees, within certain limitations pertinent to the conditions of the study, was included. The questionnaires with accompanying letters and return envelopes were mailed to the school employing officials in the sampling.

An over-all total of 72 per cent of the questionnaires was returned. This return included 51 per cent of the 88 township trustees sampled, 59 per cent of the 215 school board members sampled, 90 per cent of the 150 principals sampled, and 93 per cent of the 87 superintendents sampled.

The questionnaires were so designed that the respondents could provide a large portion of the data by checking qualitative answers to express their opinions. These data were key punched directly on punch cards and frequency distributions of the various responses were obtained from the punch cards by means of electronic data processing equipment. The questionnaires also gave the respondents opportunity to provide free response suggestions. These free response data were transcribed on cards and classified into appropriate categories for purposes of analysis. The degree of objectivity obtained in establishing these categories was checked by obtaining indexes of reliability and validity.

Subject to the limitations of this study, the findings, based upon the opinions of school employing officials, appear to justify the following conclusions:

1. Secondary teachers have a good or a very good preparation in knowledge of the subject matter they teach.
2. Indiana colleges and universities are doing a good or a very good job in preparing secondary teachers.
3. Secondary teachers who have earned the master's degree are better or much better prepared for classroom teaching than those who have only the bachelor's degree.
4. The area of preparation of secondary teachers which appears to be most in need of attention and strengthening is that of selecting and using appropriate teaching methods.
5. School employing officials consider it highly

important that secondary teachers possess professional understandings and abilities; have a thorough knowledge of the subject matter they teach; have a broad cultural background; and continue their efforts to improve their teaching through study and other activities that contribute to professional growth.

Microfilm \$2.90; Xerox \$10.15. 222 pages.

**A COMPARISON OF THE SELECTION PRACTICES
OF CERTAIN TEACHER EDUCATION
INSTITUTIONS ON STANDARD ACCREDITATION
AND ON ANNUAL ACCREDITATION
IN INDIANA**

(L. C. Card No. Mic 60-6070)

Stanley Maurice Taylor, Ed.D.
Indiana University, 1960

Chairman: Dr. Lynch

Statement of the Problem

Many of the smaller institutions in Indiana have entered the field of teacher education only recently. In some of these the path to standard accreditation by the State Department of Education has been a long and difficult one. If the results of research which points to effective selection practices can be made available to them, they may then be able to make improvements in their own programs at a minimum of time and effort.

By making a comparison of the selected practices of teacher education institutions in Indiana on annual accreditation with the institutions on standard accreditation it is proposed that the study will: (1) identify the selection practices of these two types of institutions, (2) compare the selection practices of these two types of institutions, and (3) make recommendations by which the institutions on annual accreditation could make improvements in their practices of selection. This problem raises five specific questions. These are:

1. What is the administrative structure of the selection program?
2. How are the policies of admissions to the institution interpreted in practice?
3. How are selective retention practices used to identify the good prospective teacher?
4. Do selection practices identify students who enter teaching and tend to remain in the profession.
5. What changes in selection practices are anticipated in the next five years to meet the demands for more and better teachers?

Procedure

Of the eight teacher education institutions in Indiana on annual accreditation five met these conditions: (1) privately owned, (2) more than 250 undergraduates but less than 1,000 undergraduates, and (3) coeducational. These five institutions and five institutions on standard accreditation which also met these conditions and were as comparable in size as possible were selected for the study. An interview guide was prepared and used in a pilot study after a

revision following a conference with selection officials at Ball State Teachers College. Selection officials in each of the ten institutions were interviewed to gather the necessary data needed to answer the proposed questions.

Findings

1. More of the members of selection committees in the institutions on standard accreditation are full-time teachers; they have more academic training; but they have less teaching experience in the public schools.
2. The institutions with standard accreditation use more tests at admissions and set higher minimal academic standards for unconditional admission to the institution.
3. The institutions on standard accreditation use interviews more frequently at the various stages of selection.
4. More financial assistance to students and more remedial instruction are offered by the institutions on standard accreditation.
5. A formal application to the teacher education program at a time other than at admissions is used more by the institutions on standard accreditation.
6. There is a higher per cent of rejections at almost all stages of selection by the institutions with standard accreditation.
7. A higher per cent of students who graduated from the institutions with annual accreditation enter teaching and stay in it for at least five years.
8. No institution of either type indicates any difference in the selection standards between the elementary and the secondary areas or between the teacher education and the other professional curricula in selection practices.
9. Follow-up studies and contacts with those who enter teaching are made more frequently by the institutions with standard accreditation.
10. The enrollments in the education departments in institutions with annual accreditation are increasing more rapidly than the total enrollments of their institutions, while the enrollments in the education departments in the institutions with standard accreditation are increasing slightly less rapidly than the total enrollments in their institutions.

Recommendations

The institutions with annual accreditation may find these practices worthwhile in their selection programs:

1. An application to the teacher education program at a time other than at admissions.
2. Unconditional acceptance to the institution be given only to those in the upper 1/2 of their high school class.
3. Use of more full-time teachers on the selection committees.
4. More financial aid from the institution to students who give prospects of good teachers.
5. Use of the interview at the various stages of selection.
6. More frequent use of speech tests, health examinations, and recommendations in considering applicants for admission to the institution.
7. More use of direct experiences with children as a part of the selection process.
8. Use of entrance into student teaching as a definite stage in the selection program.
9. Use of follow-up contacts with graduates and follow-up studies periodically of those who teach.

10. Use of a committee to make major decisions regarding selection and the use of a director of admissions to be responsible for administration of specific details.
Microfilm \$2.80; Xerox \$9.70. 213 pages.

**DEVELOPMENT OF AN INSTRUMENT
TO MEASURE THE ATTITUDES OF
ELEMENTARY TEACHERS TOWARD
SELECTED QUESTIONS RELATED TO
INTERNATIONAL AFFAIRS**

(L. C. Card No. Mic 61-72)

Andrew David Virgilio, Ed.D.
The Pennsylvania State University, 1960

The purpose of this study was to develop an instrument to measure the attitudes of elementary teachers toward selected questions related to international affairs. Throughout the study the attitudes concerning world-mindedness are considered. They are essentially attitudes toward selected items concerning international affairs. In carrying out this purpose, it was necessary to construct a suitable measuring instrument that would be valid and reliable.

The study consisted of the use of four different groups of teachers: 1) Elementary teachers attending two education classes on the Pennsylvania State University Campus during the summer of 1958; 2) Elementary teachers from the Elementary School of East Rochester, New York; 3) Elementary teachers from the City of Rochester, New York; and 4) Elementary teachers from Monroe County, excluding the city of Rochester. The first two groups were used in pilot studies and the last two groups were used in the final accumulation of data.

The Likert Method of Attitude Scale Construction was employed in the construction of the measuring instrument for this study.

Following two pilot studies a jury of qualified persons in the field of world-mindedness was selected. A total of fifty items was sent to this jury, and members of the jury were requested to indicate, whether or not, in their opinion, these statements would test for world-mindedness as defined in the study. World-mindedness was defined as a person's deep feeling that the welfare of his own country is tied up with the welfare of the rest of the peoples of the world.

As a result of the jury action, forty-five items were put into the third and final questionnaire on world-mindedness. This questionnaire was administered to two population samples: 1) Elementary teachers of seven schools in the City of Rochester, and 2) Elementary teachers of thirty-four schools in Monroe County. A total of one hundred and fifty-eight elementary teachers participated in the first group and a total of six hundred and sixty-seven elementary teachers participated in the second group.

The responses of these groups were handled separately. Through the chi square analysis, it was determined which of the forty-five statements had discriminatory value, and therefore, were valid. These compose the final scale of this study.

The reliability for these twenty-five items was determined through the application of the Spearman-Brown Split-Half Method and was found to be $r = .68$.

In addition to the forty-five items on the questionnaire there were six questions concerning personal data of the respondents. Some of this personal data produced indicative results. Younger teachers from the city group seemed to be more worldminded than older teachers. Age showed no evidence of being a factor in the county group. In both groups the size of home community seemed to be a factor. Elementary teachers from larger communities seemed to be more worldminded than those from smaller communities. Regarding the number of years of training, elementary teachers with four or more years of training seemed more worldminded than those with less training in the city group only. Teachers with less than fifteen years of training in the city group tended to be more worldminded. In the county group the teachers of the upper grades and in both groups the teachers who had visited more foreign countries tended to be more worldminded.

Microfilm \$2.75; Xerox \$6.80. 141 pages.

**A COMPARATIVE STUDY OF
CURRICULA STANDARDS FOR TRAINING
THE SCHOOL INSTRUMENTAL TEACHER**

(L. C. Card No. Mic 60-6073)

Harold Joseph Youcis, Ed.D.
Indiana University, 1960

Chairman: Philip Peak

The Problem

The purpose of this study was to determine the extent of agreement among standards recommended by various groups of music educators for the evaluation of the undergraduate college curriculum for the training of the school instrumental teacher.

Procedure

Data for the study was taken primarily from two sources: (1) the standards recommended by the Commission on Accreditation and Certification in Music Education of the Music Educators National Conference, and (2) standards recommended by five juries of experts who represented state colleges and universities, private colleges and universities, public schools, professional schools of music, and state departments. The questionnaire was used to obtain the opinions of the jury of experts.

The study was centered upon the examination of the following hypotheses:

1. There are no significant differences in the minimum number of semester hours the MENC Commission and the five juries recommend in the four basic areas of the teacher-training curriculum in school instrumental music, and for the baccalaureate degree in school instrumental music.

2. There are no significant differences in the minimum number of semester hours the five juries recommend for fifty-three selected courses and for free and restricted electives in the teacher-training curriculum in school instrumental music.

3. There are no significant differences in the number of jurors in each jury who recommend fifty-three selected courses and free and restricted electives in the teacher-training curriculum in school instrumental music.

4. There are no significant differences in the values which five juries place on fifty-three selected courses in terms of their importance to the training of the school instrumental teacher.

5. There are no significant differences in the sequences which five juries recommend for offering fifty-three selected courses in the teacher-training curriculum in school instrumental music.

The analysis of variance, with its subsequent t-test, and the chi-square test were used to test the hypotheses established. An inspection of the data was made to determine agreement among the juries regarding the year in which the fifty-three selected courses should be offered in the curriculum.

Major Findings

From a comparison of the findings relative to the jury and Music Educators National Conference Commission recommendations, it was found that:

1. In general, the five juries included in this study agreed with the standards developed by the Music Educators national Conference Commission for the evaluation of the teacher-training curriculum in instrumental music. The disagreements between the jury and MENC recommendations are shown as follows: (a) the public school jury recommended less study in the area of general culture, and more study in the area of professional education; (b) all juries except the state department jury recommended more study in the area of basic music; and (c) all juries except the professional school jury recommended more study for a baccalaureate degree in public school instrumental music.

2. In general, the five juries agreed with each other concerning the number of semester hours that should be allotted in each of the four basic areas of the instrumental curriculum. The disagreements among the five juries are shown as follows: (a) the public college jury recommended more hours of study in the area of general culture than did the public school jury; (b) the public school jury recommended more study in the area of professional education than did the public college, private college, and professional school juries; (c) the private college jury recommended more study in the area of basic music than did the public school and state department juries; and (d) the public school jury recommended more study in the area of musical performance than did the private college and state department juries.

3. The majority of the general education courses and non-music professional education courses were rated low by all five juries in terms of importance to the training of the school instrumental teacher. The majority of the music education, basic music, and musical performance courses were rated highly.

4. In general, the majority of the jurors in each jury did not require the following courses in the school instrumental curriculum: Library Science, Foreign Languages, Mathematics, School Curricula, Audio-visual Aids, Guidance, History of Education, Educational Measurement and Evaluation, Psychology of Music, Administration of Music Education, Measurement and Evaluation in Music, Canon and/or Fugue, Composition, and Minor Instruments which are not combined with method courses.

5. Of the members in each jury who required specific courses in the curriculum, there was general agreement

among the members with regard to the number of semester hours that should be allotted to the required courses.

6. There was little agreement among the jurors with regard to the year or years the fifty-three courses included in this study should be offered in the instrumental curriculum. Microfilm \$3.80; Xerox \$13.50. 296 pages.

EDUCATION, THEORY AND PRACTICE

THE AESTHETIC DIMENSION OF VALUE EDUCATION

(L. C. Card No. Mic 61-79)

Donald Glueck Arnstine, Ph.D.
University of Illinois, 1960

Most objects apprehended aesthetically have both an aspect of form and an aspect of symbolic content. While the experience of form, the more or less direct apprehension of the rhythmic structure of an object, is usually unrelated to anything outside the object, the experience of symbolic content is not. The experience of symbolic content, indicating more than what is presented to the senses, refers the beholder to entities not in the object and the meanings, feelings, attitudes, values, and beliefs evoked by those entities. Aesthetic experience is distinguished not only by the fact that it is always (at least) an experience of form, but also by the fact that, as long as the beholder's attention remains focused on the form of the object, his thought may encompass the extra-aesthetic evocations initiated by the object's symbolic content. Aesthetic experience is terminal because it does not lead the beholder to any other experience (either actual or imagined) that excludes the form of the object which first initiated the experience.

Terminal though it may be, aesthetic experience leaves a residue in the beholder that colors his approach to many predominantly non-aesthetic experiences. This residue is the immediately felt valuing of the entities evoked by the symbolic experience. Such valuations are the basis upon which many evaluations are later made. Nearly all cultures throughout recorded history have thus used the symbolic aspect of aesthetic experience to reinforce attitudes, values, and beliefs thought desirable. Education in the arts in American schools, however, is hampered in this attempt at reinforcement if the values embodied in the arts in its curriculum often differ or conflict with values learned more pervasively out of school.

Values gaining currency in the contemporary United States are different in many respects not only from American values of the past, but from the values that have traditionally characterized Western culture. The arts usually taught in schools embody these past and traditional values. The frequent value conflicts that result from these in-school and out-of-school influences, and the consequent ineffectiveness of value teaching in the arts in school, can be ameliorated in one of two ways. Empirical studies conducted by the writer indicated that the popular arts carried by the mass media of communication mirror the values gaining currency in American society. Such arts, then,

might form the basis of school courses in the arts; in this way the differences between in-school and out-of-school value teaching would be eliminated. If it is argued, however, that such a curriculum is for a number of reasons inadequate, the value differences and conflicts mentioned above might at least be made apparent and amenable to conscious scrutiny and discussion. This could be effected by including in the curriculum arts whose symbolic content is critical of contemporary values (not only contemporary "fine" arts, but some contemporary popular and jazz forms too), as well as retaining the more traditional fine arts whose content embodies values characteristic of the heritage of Western culture.

Microfilm \$5.40; Xerox \$19.15. 423 pages.

**ACHIEVEMENT OF THE PURPOSES
OF THE JUNIOR HIGH SCHOOL
THROUGH EXPERIENCES IN
THE PLASTIC ARTS**

(L. C. Card No. Mic 61-228)

Eugene John Aromi, Jr., Ed.D.
University of Alabama, 1960

The purpose of this study was to offer some specific examples of the relationships that may exist between the purposes of the junior high school and practices in junior high school art. In order to accomplish this it was first necessary to determine a consensus of educators' thinking in regard to the identity of the current purposes of the junior high school. In addition, it was necessary to analyze these purposes in terms of the specific tasks or obligations they imply. It was also necessary to develop a number of art experiences which are appropriate for students in the junior high school.

Chapter II provides a history of the development of the junior high school and its purposes, and contains the development of the current purposes of the junior high school. The latter were developed from a review of the current literature on the junior high school.

Chapter III is devoted to the development of the tasks which are implied by the purposes of the junior high schools, and contains a list of junior high school purposes and their related tasks. This list served as a basis for establishing relationships between the previously mentioned purposes and junior high school art experiences.

The primary purpose of Chapter IV was to develop a basis for establishing relationship between experiences in the plastic arts and the tasks implied by the purposes of the junior high school. Through a review of pertinent literature in the fields of art education, philosophy, psychology, and secondary education, a number of relationships existing between experiences in art and adjustment, learning, growth, ability, skill, habit, and value were established. These latter are the terms in which the junior high school purposes and their implied tasks are expressed.

Chapter V is devoted to a description of a number of art experiences appropriate for the junior high school level and their relationship with the purposes of the junior high school. Following the description of each experience in art its contribution to the junior high school purposes was discussed. These contributions were substantiated

through the relationship that tends to exist between the art experiences and the tasks implied by each of the purposes. This relationship was established through a discussion of their factors.

There are in the master list of purposes of the junior high school and their related tasks a total of seventy-seven tasks. The nine art experiences had a total of 703 possible contributions. The number of contributions that were identified and discussed in Chapter V was 249. The art experiences contributed to tasks representing each of the purposes of the junior high school. The art experiences made no contribution to five of the tasks.

The findings described above tend to demonstrate that a variety of art experiences appropriate for the junior high school level of development may make a significant contribution to the purposes of the junior high school. The findings further indicate that appropriate experiences in art may contribute in a number of ways to each of the junior high school purposes.

Microfilm \$3.75; Xerox \$13.05. 290 pages.

**ERRORS IN ORAL READING
OF BRAILLE AT ELEMENTARY
GRADE LEVELS**

(L. C. Card No. Mic 61-80)

Samuel Clements Ashcroft, Ed.D.
University of Illinois, 1960

The intent of this study was to provide useful information on reading in the medium of braille through critical analysis of the type, frequency, and level of errors that occur in children's oral reading at elementary grade levels.

Children in the second through sixth grade of public day and residential educational programs for blind children were asked to read aloud braille materials especially prepared for the purpose. The materials utilized the features of the braille code in twelve concise but interesting paragraphs of controlled and graded reading difficulty.

Data descriptive of the characteristics and behavior of the 728 readers were obtained. The errors made in connection with the reading in individual test situations were recorded verbatim in prescribed form. The relatively low incidence of identifiable error, an average of five errors per 100 words read, made impractical many analyses proposed at the outset of the study. Analyses for differences related to sex, educational placement, and reading history are examples.

The analyses of the findings were made on the premise that reading, regardless of medium, fundamentally involves the same psychological processes and has as its purpose the communication of meaning. An analysis of errors from the standpoint of seven types of braille orthography indicated that words having short forms prescribed by the braille code proved most difficult of the orthographic types for all grades. Words for which orthography required multiple-cell contractions were second most difficult. Words made up of combinations of orthography were third in order of difficulty. Words in these three types of orthography, while comprising 27.7% of the words in the paragraphs had associated with them 46.3% of the errors made. Words in four other types of orthography,

that is full spelling, alphabetic abbreviations, upper contractions, and lower contractions contributed 74.3% of the paragraph content, but had associated with them 53.8% of the errors made.

The errors, largely falling into eight types, were attributable to three general problems. Problems related to perception included missed dot, added dot, and ending errors. Problems related to orientation included reversal, vertical alignment, and horizontal alignment errors. Problems related to meaning included association and gross substitution errors.

The findings suggest that fruitful opportunities to reduce the number of errors in reading can be found in selection or preparation of appropriate braille materials and the instructional use of them. Further research is suggested on teaching practices, graded materials, and braille code revision.

Microfilm \$2.75; Xerox \$6.40. 134 pages.

A STUDY TO DETERMINE THE DIFFERENCES IN GAINS IN READING ABILITY BETWEEN TWO METHODS OF INSTRUCTION IN LANGUAGE ARTS

(L. C. Card No. Mic 60-6160)

Danny Wayne Boyd, Ed.D.
North Texas State College, 1960

Statement of the Problem

The purpose of this study was to determine the differences in gains in reading achievement between two seventh-grade groups taught by two different methods of instruction in language arts. One of the groups used the SRA Reading Laboratory, and the other group participated in the regular program. The effectiveness of these two methods of instruction was determined for four intellectual levels and for the two total groups.

Methods and Procedures

In this study there were used 240 seventh-grade students who were enrolled in either the experimental group or the control group. The CTMM was used to determine the Language I.Q., Non-Language I.Q., and Total I.Q. of both groups. The students in the experimental group and in the control group were separated into four intellectual levels on the basis of Total I.Q. as follows: Group I, 110 or above; Group II, 100-109; Group III, 90-99; and Group IV, 89 or below. The CAT-RS, Forms X, Y, and W were administered, respectively, at the beginning of the experiment, at mid-term, and at the end of the school year.

Four teachers were used in this study; the teachers taught their respective classes throughout the school year. Two teachers taught the experimental group the first semester of school, using the SRA Reading Laboratory. Two teachers taught the control group in regular classes in language arts the first semester of school. This portion of the study consisted of approximately sixty class periods of instruction. During the second semester of school, the experimental group participated in the regular program in language arts, while the control group participated in

the SRA reading-improvement program. This portion of the study consisted of approximately sixty class periods of instruction. The data obtained over the first semester of the school year were referred to as mid-term data; the data obtained over both semesters were called spring-semester data.

The experimental plan used in the treatment of data was the analysis of variance treatment by levels design. The *F* ration was used to test the significance of the differences between the mean changes of the two groups.

Conclusions

In the light of the evidence and within the limitations of this study, the following conclusions seem to be justified:

1. The differences in gains in reading achievement between the experimental group and the control group did not vary significantly from one intellectual level to another at the end of either the first or the second semester of school. This indicated that there was no interaction between methods of instruction and intellectual levels.

2. The differences in gains in reading achievement between the main effect of the experimental group and the main effect of the control group was not, at the end of either the first or the second semester of the school year, significantly greater than would be expected by chance.

3. The two methods of language arts instruction used in this study seemed to be similar in their effects upon the reading achievement of this sample of seventh-grade students.

Microfilm \$2.75; Xerox \$4.80. 93 pages.

A STUDY OF THE EFFECTS OF TWO TYPES OF INSTRUCTION ON THE LISTENING COMPREHENSION OF FIFTH GRADE CHILDREN

(L. C. Card No. Mic 61-502)

George Robert Canfield, Ed.D.
Syracuse University, 1960

The purpose of this study was to determine the effectiveness of direct and indirect listening instruction on the listening comprehension of fifth grade children. Direct listening instruction was defined as instruction in which the pupils were taught how to listen through guided practice in listening for main ideas and important details. Indirect instruction was defined as instruction in which the pupils' major activity was listening to a series of social studies selections read by the teacher. No mention was made of how to listen in the indirect group.

A further purpose of the study was to provide information regarding the relationship between listening and such variables as intelligence, reading and grade point average.

The Procedure

Twelve "direct instruction" lessons were taught to two fifth grade classes over a six week period. Similarly, twelve "indirect instruction" lessons were taught to two fifth grade classes during the same period. A control group received no planned instruction in listening but rather participated in the usual language arts program.

Each of the two elementary schools cooperating in the study had one fifth grade class in each of the three groups. Thus, the direct, indirect and control groups were made up of children from two different schools. A total of 149 pupils participated in the study. All of the lessons in the study were taught by the experimenter.

The Listening Test 4A and 4B of the Survey Tests of Educational Progress, published by the Educational Testing Service, were used as the criterion measure of listening skill. Tape recordings were made of the experimenter's administration of these tests before and after the six-week experimental period.

Results and Conclusions

1. Pupils receiving direct instruction in listening made a mean gain in listening that was significant at the .01 level of significance. Similarly, the group receiving indirect instruction made a mean gain that was significant at the .01 level. The control group made a mean gain in listening that failed to be significant at the .05 level. For children whose listening skills are comparable to the pupils in the direct and indirect groups in this study, both direct and indirect methods appear to be effective in improving listening skill.

2. Significant differences were found among the mean scores of the direct, indirect and control groups on the pre-test of listening skill. Therefore an examination was made of the mean gains of the groups with initial listening skill statistically controlled. Analysis of covariance indicated there was no significant difference in the mean gains of the three groups when initial listening scores were statistically controlled. The study was inconclusive in indicating the effectiveness of direct and indirect listening instruction at various levels of listening skill. Pupils who scored lower on the initial listening test tended to make largest gains.

3. A significant interaction between method and school indicated that the effectiveness of the method was dependent on which school was being considered. It is suggested that differences in teaching methods and curricula between schools can alter the relative effectiveness of the listening instruction used in this study.

4. The product-moment correlations between listening and selected variables were as follows: Silent reading, .64; Intelligence, .59; grade point average, .74. Listening skill was more highly related to report card grades than to reading skill or intelligence.

Microfilm \$2.75; Xerox \$6.80. 141 pages.

AN INVESTIGATION OF INDIVIDUALIZED READING AND BASAL TEXT READING THROUGH PUPIL ACHIEVEMENT AND TEACHER PERFORMANCE

(L. C. Card No. Mic 61-30)

Donald Eugene Carline, Ed.D.
The Pennsylvania State University, 1960

Statement of the Problem

The primary purpose of this investigation was to examine the relationships which may exist between reading

achievement as measured by the California Achievement Test, The Iowa Test of Basic Skills, and certain methods of teaching reading. These methods represent relative degrees of departure from the basal-text reading program. When a sufficient degree of departure is recognized, these methods are called individualized reading.

The following three instruments were used to evaluate reading methods: Teachers' Attitudes Toward Teaching Reading, Observations of Teachers' Reading Programs and Teachers' Self-Reports on Teaching Reading.

Hypotheses were advanced concerning the relationship between teacher performance in teaching reading and pupil reading achievement.

Procedure of the Study

The three instruments were applied to 72 teachers from two large school districts in Central Pennsylvania. The school districts administer reading achievement tests in the fall and spring of each school year. The gain for each teacher's classroom was calculated.

Product-moment correlations and t-ratios were used as statistical procedure to test each hypothesis. The Edmison Table of r's was used to determine the significance of the product-moment correlations.

Results of the Study

Each of the three instruments designed to measure teacher performance was correlated with the mean gain in reading achievement. The correlation coefficients obtained were not significant and thus nothing conclusive was revealed in this phase of the study with respect to the superiority of either the individualized approach or basal-text approach to teaching reading.

The three instruments used for direct examination of the teachers instructional program in reading were found to be interrelated. Significant correlations were found between the attitude scale and the observation scale, between the attitude scale and the self-report scale and between the observation scale and the self-report scale.

A relationship existed between the two independent observations of a teacher's reading program. A correlation coefficient significant at the 1 per cent level was found.

A test of external validation was computed for each instrument. The mean scores obtained by teachers judged to be using individualized reading practices were compared to mean scores obtained by teachers judged to be using basal reading methods. The t-ratios for the three instruments indicated that significant differences existed between the two groups of teachers. This evidence suggests that the instruments were adequately discriminating between teachers utilizing individualized and basal methods of reading instruction.

The null hypothesis stating that no significant gain in pupil reading achievement had taken place between the pre-test and the post-test administrations was rejected. A t-ratio for the means of the two tests was significant revealing children achieved more in seven months than they were expected to achieve in nine months.

Conclusions

The direct measure of teacher performance seemed to be functioning but in general the mean gains of pupils were so high that a linear relationship with either method of reading instruction was not discernible.

Microfilm \$2.75; Xerox \$6.00. 124 pages.

**A STUDY OF THE PRINCIPLES OF
TEACHING THE LANGUAGE ARTS
AND THEIR IMPLICATIONS FOR
TEACHER EDUCATION IN THAILAND**

(L. C. Card No. Mic 60-6046)

Seela Chayaniyayodhin, Ed.D.
Indiana University, 1960

Chairman: Dr. Hanne J. Hicks

The thesis had three related purposes. The first purpose was to study the basic principles underlying the teaching of language arts in the elementary schools. The second purpose was to construct a suggested language arts program, based upon the principles studied. The program was to be for the present compulsory grades and the three year primary extension grades, which are to be made compulsory in the near future. The third purpose was to study the present teacher training program. And, using the selected principles and the proposed program of the language curriculum as guides, suggest changes for the preparation of elementary teachers.

The specific purpose of this study was to form a curriculum guide which may be used or revised for use in the elementary schools within the Kingdom.

Methods and Results of the Study. The first part of the study consisted of the review of the research studies and literature concerned with the methods and the underlying principles of the teaching of the language arts. Significant principles were selected. They were made into a questionnaire checklist. The checklist was submitted to a limited number of selected educators and supervisors in Thailand for their opinions on the applicability to Thai children. Their opinions as recorded in the returned checklist were tabulated. The principles which had been agreed upon by less than 75 per cent of the participants were rejected.

The Thai curriculum guides were reviewed and analyzed. They were compared with a few selected curriculum guides issued by the state departments of the eastern, the western, and the middle western states of the United States.

The comparison showed that the state department curriculum guides were fairly detailed. The philosophy and purposes of education, physical and psychological characteristics of child development including the suggested classroom activities were described. The Thai curriculum guides were brief. There is no Thai course of study written which enumerates in detail.

A suggested curriculum plan for teaching language arts in Thai schools was presented. The plan was divided into two separate sections. They were for the four year primary schools and for the three year primary extension schools. All areas of language arts were included in both sections. A general philosophy of education, purposes of teaching language arts, instructional materials, and methods of evaluation were briefly discussed.

A brief review of the preparation of Thai elementary teachers was presented historically. Analysis of the present teacher training curriculum was made. The total pre-service language training of the elementary teaching profession was also analyzed. These provided a background for the suggestions for improvement.

A list of recommendations regarding the preparation of

elementary teachers in Thailand was given for both the general education and the professional training of future teachers. Microfilm \$2.90; Xerox \$10.15. 224 pages.

**EXPERIENCES IN GENERAL BIOLOGY
IN THE SECONDARY SCHOOL WHICH
MAY CONTRIBUTE TO THE OBJECTIVES
OF GENERAL EDUCATION**

(L. C. Card No. Mic 61-231)

William Frank Dodson, Ed.D.
University of Alabama, 1960

The purpose of this study was to show how experiences in secondary school general biology could make a contribution to the objectives of general education. In order to do this, experiences were designed and related to specific types of behavior which were in turn related to the objectives of general education.

The thesis that general biology is and should be a part of the general education program in high school was supported by evidence from the reports of committees and associations, by the fact that a majority of students enroll in courses in general biology and by the opinions of writers in the field of secondary school science.

For the purpose of this study, general education was defined as that part of the secondary school program which should help to supply those common learnings that every youth needs in order to live a competent and satisfying life in his society and to maintain and improve that society of which he is a part.

An organization of behavioral outcomes was developed in the publication Behavioral Goals of General Education in High School for relating desirable specific behaviors to the objectives of general education. The publication included a list of desirable behavioral outcomes which were supported by more specific kinds of behavior.

A check list containing forty-eight behavioral goals, selected from the list proposed in the above publication was submitted to eleven secondary school general biology teachers who were asked to check those behavioral outcomes to which they thought experiences in general biology should make some contribution. Twenty-seven behavioral outcomes were considered of sufficient importance to be included in this study. Eighty supporting specific behaviors, which were of "high" importance in the opinion of 90 per cent of the reviewers of the study of behavioral outcomes of general education, were selected as applicable to general biology.

A major part of the study was devoted to the determination of widely accepted content areas in general biology, the formulating of a list of criteria for developing experiences in general biology, the designing of ten experiences and the relating of these ten experiences to the accepted content areas of general biology and to the selected specific behaviors.

The widely accepted content areas of general biology, as evidenced by an analysis of twelve biology texts and courses of study, are physiology and morphology of plants and animals, health, ecology, conservation and evolution.

Ten experiences in general biology were designed to meet the following criteria:

1. The experience should contribute to one or more of the selected specific behaviors.
2. The experience should relate to an accepted content area.
3. The experience should provide for the active participation of the learner. In other words, the experience should provide an opportunity for the student to act, think or feel - to behave - in a desirable way.
4. The experience should be one that can be achieved by the more mature students and, at least to some degree, by all students.

The relationship of the designed experiences to accepted content areas and to the selected specific behaviors are presented in tabular form which is followed by a description of the contributions that the ten experiences are expected to make to the eighty selected specific behaviors.

Two recommendations for further study are:

1. A study could be developed to test the designed experiences and to evaluate the outcomes in terms of expected specific behaviors.
2. A study to develop a more extensive list of experiences of the type designed in this study.

Microfilm \$2.75; Xerox \$8.80. 193 pages.

**A STUDY OF THE EASEL PAINTINGS
OF KINDERGARTEN, FIRST- AND
SECOND-GRADE CHILDREN IN DIRECTED
AND FREE CHOICE ACTIVITIES.**

(L. C. Card No. Mic 60-3307)

Nancy Jones Douglas, Ed.D.
The Florida State University, 1960

The purpose of the study was to determine whether or not teacher direction affected children's paintings. The investigation also sought to determine whether there would be a significant difference in the effect of direction on children of different grade levels and between children in the upper and lower ten per cent of the class intellectually. The study was based on the easel paintings of children in kindergarten, first- and second-grades in free choice and directed situations. Two types of direction were employed: (1) one in which the children were asked to paint, and (2) one in which they were told what to paint.

Literature relating to the use of children's drawings as a means of understanding children was reviewed. Data for the study were obtained from the paintings of sixty-three children enrolled in the Florida State University School. Complete sets of nine paintings each were available for each child.

These paintings were rated individually by three trained raters who used the Easel Age Scale developed by Beatrice Lantz. The effects of direction were determined by the number of "Q" or "feeling" paintings and the scores of paintings produced in each type of situation were statistically tested for degree of difference by grade levels. The upper and lower ten per cent intellectually of each grade were identified and their scores were statistically compared.

The findings showed that: (1) teacher direction affected children's paintings; (2) the effect of teacher direction on children's paintings was not entirely negative; (3) direction to paint without guidance as to the subject matter appeared to be frustrating (more "Q" paintings occurred in this directed type of situation); (4) types of situations in which highest scores were produced varied from "directed what" at the kindergarten level to "free choice" at the second grade; (5) "Q" paintings, designated as "feeling" paintings, did not give an adequate measure of the children's maturity according to the California Easel Age Scale.

It was recommended that further investigations be made into: (1) the most effective type of guidance in the graphic arts for young children; (2) the effects of teacher direction on children using other types of art media; (3) the "Q" paintings to determine whether they follow a pattern in relationship to basic emotional responses of the child; (4) the possibilities of utilizing the graphic arts in predicting abilities of the slow learner; (5) the effects of direction on the creative aspects of paintings; and (6) the effects of direction on the individual child.

Microfilm \$2.75; Xerox \$3.60. 65 pages.

**AN APPRAISAL OF CLASSROOM PRACTICES
CURRENTLY USED BY TEACHERS OF
ENGLISH AS A FIRST FOREIGN LANGUAGE
IN THE EGYPTIAN GOVERNMENT
ACADEMIC SECONDARY SCHOOLS, 1959-60.**

(L. C. Card No. Mic 60-6614)

Mahmoud Ibrahim EL Laissi, Ph.D.
The University of Texas, 1960

Supervisors: Geneva Hanna and
J. G. Umstattd

Purposes. The purposes of this study were four-fold: (1) to establish a set of guiding principles for the advanced English program in the Egyptian school; (2) to present the status of English as a first foreign language in the Egyptian government academic secondary schools in the following aspects: objectives, time allotment, instructional activities, availability and extent of use of instructional materials, and teacher background; (3) to appraise classroom practices in light of the established principles; (4) to indicate recommendations for the improvement of the advanced English program in the Egyptian school.

Procedures. The data gathered, presented, and appraised in this investigation came from two main sources. The first of these consisted of information from correspondence with the chief inspector of English, Egyptian Ministry of Education, Dean Abdelazeem Darweesh who supplied the information relative to current offerings, time allotment, and textbooks in government secondary school English as a first foreign language. The other source of data was the teachers of English as a first foreign language in each Egyptian government academic secondary school. In response to a questionnaire prepared by the investigator the teachers furnished information relative to their experience and preparation, objectives in the teaching of advanced English, instructional activities, and audio-visual aids. The data gathered, having been

submitted to the process of classification and tabulation, were then appraised in light of sixteen guiding principles for the advanced English language program in the Egyptian school. These guiding principles had been derived from research findings and writings that reflect opinions of authorities in the fields of secondary education and modern language teaching.

Conclusions. The following conclusions were made regarding the classroom practices used by teachers of English as a first foreign language in the Egyptian government secondary school:

1. One motive for the study of English in the scientific section of the secondary school was thought important by over half of the teachers; this was to gain a reading ability of scientific and technical works in English.
2. One motive for the study of English in the literary section of the secondary school was thought important by over half of the teachers; this was to gain understanding of American and British literature.
3. Teachers appear to be unaware of the importance of the cultural motive for the study of English.
4. Each of the four language skills was emphasized by the majority of the second- and third-year teachers, but with no special emphasis determined by national needs.
5. Teachers did not provide adequately for the achievement of each individual.
6. Teachers helped students overcome their tendency to transfer to English their Arabic sounds and patterns.
7. The majority of learners were not familiar with understanding or responding to the speech of native English speakers.
8. Teachers placed faith in intensive oral practice for the establishment of automatic control of English structure patterns.
9. The five activities related to developing the students' interest in wide reading were used much by slightly more than one-third of the teachers.
10. The four linguistic skills were regarded as interactive and interdependent.
11. Teachers appear to believe that the student should acquire the habits of noticing mistakes in his own writing and of feeling responsible for them.
12. Audio-visual techniques were to a limited extent an integral part of the teaching-learning situation.
13. The reading program in advanced English does not lead a science major to the technical vocabulary needed in his college life.
14. The student leaves the advanced English course without gaining an understanding and appreciation of American and British contemporary works of literary value.
15. The prescribed textbooks do not give evidence of having been selected to give insight into the characteristics of the American or British culture.

Microfilm \$2.90; Xerox \$10.15. 224 pages.

SELECTED TOOLS OF ANALYTIC PHILOSOPHY AND THEIR APPLICATION IN EDUCATION

(L. C. Card No. Mic 60-6667)

George Willard Ferree, Jr., Ed.D.
The University of Florida, 1960

Many thinkers within the field of education today recognize that the difficulties they encounter in deliberating about education often are complicated by or are a consequence of linguistic confusions. This dissertation has sought to provide such thinkers with tools developed within the field of analytic philosophy which show promise of eliminating or, at least, of reducing certain of these linguistic confusions.

More specifically, this dissertation has sought to accomplish four purposes: (1) to provide a broad survey of the philosophic movements in which tools for the analysis of language have been developed and used; (2) to specify and explain selected linguistic tools useful in education; (3) to exemplify the use of these tools in their application to educational discourse; and (4) to suggest the appropriate role of linguistic tools within the discipline of philosophy of education. Corresponding to these four purposes, the dissertation has four parts.

The chief function of the first part, comprising Chapter I, is to provide a broad context, so that the reader will more easily understand the specific work accomplished in Parts Two and Three. Part One broadly differentiates analytic philosophy from other kinds of philosophy, identifies the major movements within analytic philosophy, and in a general manner discusses some matters of major concern to analytic philosophers.

Part Two, comprising Chapters II and III, specifies, explains, and illustrates the use of particular tools of linguistic analysis which have applicability in the discipline of education. Chapter II treats tools for identifying and coping with ambiguous expressions and with vague expressions. Chapter III provides tools for the analysis of sentences which constitute or which often are interpreted as definitions.

The third section of this dissertation, Chapter IV, further exemplifies the use of the tools explained in Part Two, applying them to expressions appearing within the context of a lengthy educational treatise, the report of the Harvard committee on General Education in a Free Society. By discussing the tools in their applications to such expressions, Part Three demonstrates their role in the clarification of an extended educational rationale. Part Three shows that the effectiveness of the Harvard report--at least, its effectiveness as a guide to educational practice--is considerably impaired by its use of ambiguous and vague expressions and by its employment of inadequately formulated definitions. The section does not repudiate or finally reject the Harvard report but rather suggests means for rendering its rationale clearer and more cogent.

The fourth and final section of this dissertation, Chapter V, briefly discusses the role of the tools of analytic philosophy within the field of philosophy of education. The discipline of philosophy of education--at least, as treated in Chapter V--differs from so-called "pure" philosophy in that its formulations must meet or, at least, take into account the tests of actual practice. Teachers have to do

something when they are faced with students in a classroom, and educational administrators must make decisions of policy which influence the ways schools are in fact run. The sensitive educational philosopher, accordingly, always takes into account the necessity for "translating" his formulations into "doings." Part Four broadly considers how the tools of analytic philosophy may be of service to the philosopher of education, noting especially the extent to which such tools contribute, immediately or ultimately, to the guidance of educational practice. The section suggests that the tools of analytic philosophy do have an appropriate--indeed, a necessary--role in educational philosophy and that philosophers of education cannot afford to remain ignorant of the analytic approach.

Microfilm \$2.75; Xerox \$8.80. 192 pages.

**A STUDY OF THE RELATIVE
EFFECTIVENESS OF SELECTED
INSTRUCTIONAL PROCEDURES IN
A COLLEGE COURSE IN
CHILDREN'S LITERATURE**

(L. C. Card No. Mic 60-6804)

Alice Irene Fitzgerald, Ed.D.
University of Missouri, 1960

Supervisor: L. G. Townsend

PURPOSE: The purpose of this study was to determine the relative effectiveness of selected instructional procedures for the learning of college students in a course in Children's Literature. Specifically, the study proposed to determine the relative effectiveness of lecture, discussion, and independent study procedures upon the achievement of college students in a course in Children's Literature.

METHOD OF RESEARCH: The experimental method of research was used in conducting the study. The study was designed to compare the achievement of three groups of college students in a course in Children's Literature taught by lecture, discussion, and independent study. Ninety-one students were included in the study. They were undergraduates of sophomore, junior, and senior status; they were women students between the ages eighteen and twenty-two; and they had no teaching experience.

The course in Children's Literature upon which this study was based was organized into three sections during the fall semester of 1959-1960. For the purpose of this investigation each of the sections followed a different instructional procedure throughout the entire semester. The content of the course and the objectives were the same for each of the three sections. The same instructor taught all three sections. An effort was made on the part of the instructor to provide equal motivation for all students regardless of the instructional procedure that was followed.

The evaluation criterion was achievement in terms of gains in learning as defined by specific objectives of the course. Two measures of achievement were obtained; these included objective measures of the

students' knowledge of the subject matter of the course and an acquaintance with children's books. Pretests and post tests were administered and the gain scores were used as the criterion variable.

In addition to the measures of gains in achievement, the level of performance of the students was determined for the following abilities: background knowledge of the subject, academic ability, scholastic aptitude, and literary comprehension and appreciation. The performance scores obtained from these measures were used as control variables.

Two basic tests of significance were employed in the analysis of the data that were collected during the investigation. Analysis of covariance was used to determine the significance of differences in achievement among the means of the three groups taught by the different instructional procedures. The application of this statistical technique also made adjustments for initial inequalities that existed among the means of the three groups whose members were measured with regard to the background abilities previously named. The t-test was used to determine the significance of the gains in achievement for each of the three groups.

SUMMARY AND CONCLUSIONS: Within the limitations of this study, there were no significant differences in the effectiveness of lecture, discussion, and independent study procedures for learning in a college course in Children's Literature. The tests of significance of differences in achievement (gains) among the means of the three groups revealed F-values that were non-significant at the 5 per cent level of confidence. The tests of significance of the gains for each group revealed t-values that exceeded the probability at the 1 per cent level of confidence.

1. There were no significant differences in achievement as defined by the objectives of the course among the three groups.

2. There were no significant differences in achievement of an acquaintance with children's books among the three groups.

3. Regardless of the instructional procedure followed, each of the three groups made significant gains in achievement as defined by the objectives of the course.

4. Regardless of the instructional procedure followed, each of the three groups made significant gains in achievement of an acquaintance with children's books.

Microfilm \$2.75; Xerox \$6.60. 139 pages.

AN EXPERIMENTAL EXPLORATION OF
THREE COMMUNICATOR-STRATEGIES FOR
INCREASING THE PREDICTABILITY
OF PICTORIAL CUE: VERBAL
RESPONSE RELATIONSHIPS.

(L. C. Card No. Mic 60-6050)

Malcolm Lee Fleming, Ed.D.
Indiana University, 1960

Chairman: Dr. Henry A. Bern

Statement of Problem

The purpose of this study was to examine the relationship between the manipulation of pictorial stimuli by a communicator (experimenter) and the subsequent verbal responses by communicatees (subjects). The manipulation of stimuli was done according to three communicator-strategies (derived from theoretical considerations) for "controlling" the level of abstraction of verbal responses. A series of 36 pictures were designed according to the following communicator-strategies:

1. Manipulation of the over-all number of stimulus attributes in the pictures.
2. Manipulation of the number of attributes common to members of a pair of figures shown in the pictures.
3. Manipulation of relevant attributes for object, form, and number in separate pictures.

The relationships between the strategies and responses were hypothesized as follows:

1. The concrete-to-abstract level of verbal response to one pictured object will vary inversely with the over-all number of pictorial attributes employed.
2. The concrete-to-abstract level of verbal response made to two pictured objects will vary inversely with the number of pictorial attributes that are common to both objects.
3. The particular class of verbal response to a pair of pictured objects will be positively related to one of three classes--object, form, or number--depending upon which set of relevant attributes has been made most available.

Sources of Data

Thirty subjects were randomly selected from the seventh grade population. Each was individually shown each picture and asked to make the following responses:

1. A free response consisting of a name for the picture.
2. A fixed alternative response consisting of the matching of a series of names to the picture.

The free oral responses were tape recorded, and the matching responses were entered on a printed sheet.

The free response names were classified by three judges according to their abstractness, using the criterion of inclusiveness of the class.

Both free response and fixed alternative data for Strategies 1 and 2 were subjected to non-parametric statistical analysis including the Friedman Two-Way Analysis of

Variance by Ranks and the Sign Test. The fixed alternative data for Strategy 3 were subjected to the X^2 One-Sample Test.

Findings

Hypotheses 1 and 2 were supported at levels of confidence greater than .001 according to Friedman's Analysis for all of the conditions. However, the differences between several individual pictures were shown to be of no significance according to the Sign Test. These findings held for both free response and fixed alternative data.

Hypothesis 3 was supported at levels of confidence of .02 or greater by the fixed alternative data for all the pictures emphasizing form, for most of the pictures emphasizing number, and for one of the pictures emphasizing object. Free response data was not amenable to analysis.

Conclusions

Generally, it can be said that this exploratory study has demonstrated that verbal responses can be controlled as to level of abstractness by general principles (strategies) of stimulus manipulation.

Specifically, the following conclusions can be drawn from the evidence:

1. A reduction in the number of attributes exhibited by a pictured object tends to increase the abstractness of verbal response.
2. A decrease in the number of common attributes exhibited by two pictured objects tends to increase the abstractness of verbal response.
3. Changes in the organization and illumination of pairs of pictured objects so as to emphasize certain relevant attributes can increase the predictability of verbal responses among three classes--object, form, and number.

Microfilm \$2.75; Xerox \$6.40. 135 pages.

A COMPARATIVE STUDY OF THE
ACHIEVEMENT OF EIGHTH- AND
NINTH-GRADE ALGEBRA PUPILS IN THE
WICHITA INTERMEDIATE SCHOOLS

(L. C. Card No. Mic 61-276)

Edwin J. Friesen, Ed.D.
University of Kansas, 1960

1. Statement of the Problem. The mathematics curriculum of the Wichita, Kansas Intermediate (Junior High) Schools consists of one year of seventh-grade mathematics and a year of eighth-grade mathematics with a choice of ninth-grade general mathematics or beginning algebra in the ninth grade. Pupils qualify for ninth-grade algebra by making an average grade of "B" or better in eighth-grade mathematics. In the fall of 1958 each of nine intermediate schools selected one class of mathematically talented incoming seventh-grade pupils for an accelerated mathematics program. The seventh- and eighth-grade mathematics curriculum of these pupils was "telescoped" into their first year and when they were in the eighth grade they were enrolled in beginning or ninth-grade algebra.

The purpose of this study was to compare at the end of the year of instruction the achievement in algebra of the eighth-grade pupils with the achievement of the ninth-grade pupils, holding constant the effects of intelligence and initial status in algebra aptitude.

2. Procedure. Three tests involving 211 eighth-grade pupils and 774 ninth-grade pupils in the nine schools participating in the program were administered. An intelligence test and an algebra aptitude or pre-test were given at the beginning of the school year to provide for taking into account the effects of intelligence and algebra aptitude. An algebra achievement or post-test was administered at the end of the school year to measure achievement. Since the schools in the study represented a wide range of socio-economic areas, the investigation was conducted on an individual school basis; i.e., each eighth-grade class was compared with the ninth-grade classes of the same school. The technique of analysis of variance and covariance was selected as the appropriate statistical tool to use. By means of this technique two groups of unequal number could be compared in algebra achievement holding constant the factors of intelligence and initial status in algebra aptitude. Ninth-grade classes that met the assumptions of pooling were pooled.

3. Findings. As a result of pooling, it was possible to make 13 comparisons. In four of the comparisons there were significant differences in favor of the eighth grade at the one per cent level. However, in one of these four comparisons, it was concluded that the eighth-grade advantage could have been due to the greater initial knowledge these pupils possessed as indicated by the pre-test scores. In the other nine comparisons in which there were no significant differences the adjusted or real mean, whichever was used in the final analysis, was in favor of the eighth grade.

Incidental to the main purpose of the study, it was discovered that the findings could not definitely be related to the college preparation in mathematics of the participating teachers and/or the methods of teaching which they employed. However, a systematic study designed to test this relationship might reveal findings attributable to either or both of these factors.

4. Conclusions. The conclusions were: (1) Mathematically talented eighth-grade pupils comprising the upper 10 to 15 per cent of their class achieved as well or better in algebra than selected ninth-grade pupils. (2) Acceleration is one means of developing the abilities of mathematically talented pupils. (3) The junior high-school conventional mathematics curriculum should be reevaluated and reorganized to meet more adequately the needs of pupils having special aptitude in mathematics.

Microfilm \$2.75; Xerox \$9.00. 200 pages.

A PHILOSOPHIC APPROACH TO CRITICISM OF SCHOOLS

(L. C. Card No. Mic 60-4921)

Nelson Lionel Haggerson, Jr., Ph.D.
The Claremont Graduate School, 1960

Criticism of public schools has led to much anxiety on the part of professional school people. This dissertation

is an endeavor to alleviate some of the anxiety by analyzing the nature of certain criticisms--demonstrating that these criticisms are inherent in philosophies of education and that criticism by certain scholars is inevitable.

The problem is to demonstrate that: Public schools will inevitably be criticized by those who base their judgments on a consistent philosophic system.

The critics studied are advocates of Scholasticism, Idealism, and Pragmatism. Robert M. Hutchins, Mortimer J. Adler, Jacques Maritain, John D. Redden, and Francis A. Ryan are among the scholastics. The idealists include Herman H. Horne, J. Donald Butler, Rupert C. Lodge, B. B. Bogoslovsky, and Theodore M. Greene. John Dewey, William Kilpatrick, John Childs, and Boyd Bode are among the pragmatists.

Four basic assumptions--the nature of philosophy, the nature of man, the nature of knowledge, and the nature of values--and their educational implications were analyzed. These basic assumptions of Scholasticism, Idealism and Pragmatism were found fundamentally incompatible. Furthermore, the educational implications are, for the most part, irreconcilable. Therefore, the advocates of each philosophy, by their very philosophic convictions, must criticize the basic assumptions of each of the other philosophic positions.

Each of the three schools of thought derives its educational principles from its fundamental philosophic tenets. An ideal school based on these principles and advocated by proponents of one philosophical position would, as the basic assumptions themselves, be subject to criticism by those founding their beliefs in the other two philosophies.

Three ideal curricula (from the point of view of the philosophies being studied) were envisioned. Each was logically criticized from the theoretical position of the other two philosophies.

The public schools, however, because they are restricted by laws, because they are controlled and operated by individuals or groups having different (or no) philosophic views, because they are subject to many publics and many pressures, cannot be ideally "scholastic," "idealistic," or "pragmatic." It is concluded, then, that public schools are inevitably subject to criticism by accordant supporters of Scholasticism, Idealism, and Pragmatism.

The curriculum of a representative public high school was used to demonstrate the point. It was found to be subject to criticism by scholastics, idealists, and pragmatists.

While the critics studied here are few in number, their criticisms are widespread as evidenced by the literature. They seem to be representative of the scholars who are attacking the schools from philosophic positions. This analysis leads to the conclusion that their criticisms are sincere and are based on philosophic conviction. They do not appear to be directed at the integrity of the school people themselves.

An analysis of this type, if it accomplishes the desired purpose, might well point to the need for further study of the real nature of criticism. These studies may lead school people to recognize that if they are to withstand such incursions they need a firm philosophic basis on which to operate and from which to answer criticism.

Microfilm \$3.10; Xerox \$10.80. 238 pages.

**A COMPARATIVE ANALYSIS OF
POST-HIGH-SCHOOL BOOKKEEPING
EXPERIENCES OF SELECTED
BUSINESS STUDENTS**

(L. C. Card No. Mic 60-6707)

Braxton Comer Henderson, Ed.D.
Stanford University, 1960

Purpose

The purpose of this study was to assess certain vocational and nonvocational claims of value being made for the high school bookkeeping curriculum through an analysis of activities relevant to these claims in the experiences subsequent to graduation of former high school business students.

Procedure

By means of interviews and questionnaires, data on vocational and nonvocational financial record-keeping activities during a period of fifty-seven months commencing immediately following high school graduation were gathered for two populations of former high school business students. One population consisted of cases who had completed work in business education in high school, including at least one semester of bookkeeping instruction; the other population had completed work in business education in high school, but had received no bookkeeping instruction. These data were analyzed to determine whether significant differences in the area of financial record keeping, vocational or nonvocational, existed between the populations. The five per cent level of confidence was accepted as significant for the purposes of this study.

Bases of comparison used in this study included the performance of bookkeeping activities as a major part and a minor part of employment expressed as a proportion of business employment, all employment, and total time subsequent to graduation for each population. Further comparison was made of the number of individuals in each population experiencing use of bookkeeping learnings during the period of this study.

Results

Former business students who studied bookkeeping in high school were performing bookkeeping duties vocationally slightly more than were comparable students who had not studied bookkeeping, but this difference was not statistically significant on any of the bases of comparison used in this study.

Slightly less than ten per cent of the population which had studied bookkeeping had performed the complete bookkeeping cycle at any time during the fifty-seven months covered by this study.

Conclusion

A basic rationale of this study was that one test of the values attributed to the bookkeeping curriculum would be a determination of whether those business students who study bookkeeping subsequently engage in activities which evidence use of bookkeeping learnings significantly more than do those who do not study bookkeeping. On the basis

of this rationale it is concluded that vocational and non-vocational values being claimed for high school bookkeeping instruction cannot be substantiated by the data analyzed in this study.

Microfilm \$2.75; Xerox \$5.00. 96 pages.

**AN ANALYSIS OF THE ACHIEVEMENT
OF SEGREGATED AND NON-SEGREGATED
GIFTED PUPILS**

(L. C. Card No. Mic 60-5240)

Roberta Meade Kellogg, Ph.D.
The University of Connecticut, 1960

Since 1940 the public schools of Brockton, Massachusetts, have maintained a program for the education of gifted pupils in the elementary school grades. This is a longitudinal, descriptive study of the results of this particular program.

The purposes of the present study are (1) to find the differences in the educational achievement of those pupils who spent three years in special high level classes in elementary grades and in the educational achievement of pupils of like intellectual ability who proceeded through the elementary schools in regular heterogeneously grouped grades, and (2) to ascertain whether the homogeneously grouped pupils assumed more leadership roles as evidenced by holding positions of responsibility while in high school.

Two hundred eighty-six gifted pupils were involved in the study. Of these 144 were placed in special classes for three years. They were given the advantages of specially chosen teachers, peer group stimulation, small class size, and enriched curriculum opportunities.

The 142 pupils who were not placed in the special program proceeded through the regular grades in classes that embraced a wide range of ability and achievement. Neither their teachers nor their program were chosen especially for them but they were subjected to the varying degrees of teaching efficiency that are found in the average community.

The I. Q. range of both groups is 128 to 171; the SPECIAL group range is from 128-169; the REGULAR group range is from 130-171. The median of the SPECIAL group is 141; the median of the REGULAR group is 136.

A study of the achievement test results indicated that significant differences at the 5 per cent level in favor of the SPECIAL group were found in the areas of reading, spelling, social studies, and science at the sixth grade level with those pupils who are now in secondary schools. There was a significant difference for this same group at the eighth grade level in language usage, spelling, and arithmetic reasoning.

There were for those pupils beyond the secondary schools significant differences between the SPECIAL and the REGULAR groups in the areas of language usage and arithmetic reasoning. No difference was demonstrated between these groups at the eighth grade level.

A study of the Cooperative test percentile scores showed no significant differences between the groups.

A longitudinal study of teachers' marks at the secondary school level showed that no difference exists between the two groups.

The SPECIAL group showed significantly greater activity in the roles of class officers than did the REGULAR group.

Participation in the program for gifted pupils has resulted in some positive gains for the segregated group. The academic gains as reflected in achievement test scores seem to level off as the pupils go through high school. There seems to be real evidence that the segregated group become class leaders.

The continuance of the program is recommended on the basis of the present findings.

Microfilm \$2.75; Xerox \$6.00. 123 pages.

AN ANALYSIS OF TRENDS IN SELECTED GRADUATE AUDIOVISUAL EDUCATION PROGRAMS

(L. C. Card No. Mic 60-6060)

Austin Carlyle Knapp, Ed.D.
Indiana University, 1960

Chairman: Beryl B. Blain

Problem

Communication theory has found some application in audiovisual education at the graduate level, but there still is a paucity of data regarding the extent to which this approach has been accepted by the audiovisual field. Also, there is little specific information available as to the nature and content of communication theory as it is being taught in graduate communication programs.

Purpose

This study was undertaken for two basic purposes. These were:

1. Determination of audiovisual education leadership opinion regarding the inclusion of communication theory content in graduate audiovisual programs; and
2. Determination of content in communication theory courses which are required on advanced-degree programs in communication.

Procedure

This inquiry was restricted to courses which by title, content, and administrative location within the communication program appeared to have as their main purpose the study of communication theory as such.

Current graduate-school catalogs, professional books and journals, as well as periphra, were searched to discover the general nature of the content being included in courses titled 'communication theory.' Data were accumulated exclusively from programs offering a communication major at the master's level or above.

Two survey instruments were developed on the basis of this information. One was for the audiovisual education leadership and the other for teachers of required courses in communication theory within graduate communication programs. Each instrument had for its principal item an identical list of 50 communication theory content-classifications.

The audiovisual leaders were asked to indicate the proportion of total communication theory class-time they would like to see spent on each of the content-classifications they selected from the list. The communication theory teachers were asked to respond in terms of the number of 50-minute class-periods they normally spend on each of the content-classifications they cover.

Findings

The mean minimum requirement for work in communication theory in the field of communication is practically identical with the mean desirable amount indicated by audiovisual leaders.

Almost all the audiovisual respondents felt that communication theory should be a significant part of graduate audiovisual programs. They also indicated preference for teaching the material within the structure of the audiovisual department. Most respondents stated that they now are including at least some communication theory content in their graduate audiovisual courses.

Conclusions

There is no significant opposition to the communication approach at the professional level in audiovisual education.

Between 15 and 20 per cent of total class-time within the graduate audiovisual education major (six to nine semester-hours) probably will be spent on communication theory in the future.

Production will continue to occupy a preeminent position among the principal areas of emphasis within the graduate audiovisual education major.

Recommendations

Further investigation into this entire area of program content and emphasis is needed.

The basic assumption that all respondents were functioning within the same cognitive field relative to the survey instruments should be examined further before being accepted as valid.

This study was concerned with audiovisual leadership opinion. A status-study should be made to find out the amount and character of the communication theory now included in audiovisual programs.

An investigation similar to this one should be made to determine the views of audiovisual leaders in public education relative to the general content of graduate audiovisual programs, and particularly regarding the desired amount of communication theory to be included in such programs. Microfilm \$2.75; Xerox \$7.00. 146 pages.

THE RELATIONSHIP BETWEEN CERTAIN
PSYCHOLOGICAL TESTS AND
SHORTHAND ACHIEVEMENT AT
THREE INSTRUCTIONAL LEVELS

(L. C. Card No. Mic 60-6809)

Mary Jane Lang, Ed.D.
University of Missouri, 1960

Supervisor: Ralph K. Watkins

PURPOSE: The major purpose of this study was to ascertain the relationship between certain factors considered pertinent to success in the study of modern foreign languages and shorthand achievement at three instructional levels. More specifically, the study sought to relate the following factors (singly and in combinations) to dictation and transcription achievement of elementary, intermediate, and advanced stenography students at the university level: aptitude for modern foreign languages, vocabulary, linguistic ability, and general scholastic aptitude.

METHOD OF RESEARCH: The raw data for statistical analysis were provided by 184 students enrolled in elementary, intermediate, and advanced stenography courses in the College of Education, University of Missouri, during the second semester of 1958-1959 and the first semester of 1959-1960.

These psychological tests were administered to provide measures of aptitude for modern foreign languages, vocabulary, linguistic ability, and general scholastic aptitude: the Iowa Placement Examinations--Foreign Language Aptitude, Form M; the Cooperative Vocabulary Test, Form Q; and the A. C. E. Psychological Examination, 1952 Edition.

The highest speed at which students wrote shorthand for material dictated for five-minute periods and prepared transcripts of at least 95 per cent accuracy on two of four sequential tests constituted dictation and transcription achievement.

SUMMARY AND CONCLUSIONS:

1. The Iowa Placement Examinations--Foreign Language Aptitude, Form M, yielded a substantial positive relationship with dictation and transcription achievement at each of the three instructional levels.
2. The Cooperative Vocabulary Test, Form Q, provided a substantial positive relationship with dictation and transcription achievement at the elementary and intermediate levels and a low positive relationship at the advanced level.
3. The Linguistic Section, A. C. E. Psychological Examination, 1952 Edition, revealed a substantial positive relationship with dictation and transcription achievement at each of the three instructional levels.
4. The A. C. E. Psychological Examination, 1952 Edition, yielded a substantial positive relationship with dictation and transcription achievement at the elementary level and a low positive relationship, at the intermediate and advanced levels.
5. The Iowa Placement Examinations--Foreign Language Aptitude, Form M, and the Cooperative Vocabulary Test, Form Q, combined with either the Linguistic Section, A. C. E. Psychological Examination,

1952 Edition, or the entire psychological examination provided the highest degree of relationship with dictation and transcription achievement at the elementary level.

6. The Iowa Placement Examinations--Foreign Language Aptitude, Form M, combined with either the Cooperative Vocabulary Test, Form Q, or the Linguistic Section, A. C. E. Psychological Examination, 1952 Edition, effected the highest degree of relationship with dictation and transcription achievement at the intermediate level.

7. The following combination provided the highest degree of relationship with dictation and transcription achievement at the advanced level: the Iowa Placement Examinations--Foreign Language Aptitude, Form M; the Linguistic Section, A. C. E. Psychological Examination, 1952 Edition; and the Cooperative Vocabulary Test, Form Q.

8. The highest coefficient of correlation yielded by a single measure, .60 between the Iowa Placement Examinations--Foreign Language Aptitude, Form M, and dictation and transcription achievement at the elementary level, accounted for only 36 per cent of the total variance. This test is, therefore, inadequate as a single predictor of dictation and transcription achievement at the elementary level.

9. The highest multiple coefficient of correlation, .63 yielded by two combinations of three independent variables at the elementary level, accounted for only 40 per cent of the total variance in dictation and transcription achievement. These combinations exert insufficient control to serve as sole bases for predicting dictation and transcription achievement at the elementary level.

10. The greater proportion of the variance in dictation and transcription achievement at the elementary, intermediate, and advanced stenography levels is possibly attributable to factors not measured in this study.

Microfilm \$2.75; Xerox \$9.00. 199 pages.

THE HEURISTIC STANDPOINT IN
THE TEACHING OF ELEMENTARY CALCULUS

(L. C. Card No. Mic 60-6740)

Charles McLoud Larsen, Ph.D.
Stanford University, 1960

Can elementary calculus be taught in a manner that will help develop the ability of students to solve mathematical problems? This general question, which underlies this dissertation, identifies the "heuristic standpoint" as one which emphasizes problem-solving. There is no doubt that students can learn to solve a great many routine exercises, but such exercises do not qualify as true problems. A "problem" is assumed to involve a goal for which the student does not have a ready plan of attack, and the basic question is therefore one of helping students develop some measure of creativity in solving problems.

While he cannot hope to improve his students' inherent capacities for creativity, a teacher of elementary calculus can hope to offer his students a number of general suggestions, independent of the details of particular problems,

which may facilitate their task in reconstructing their experience to meet a new problem. Such suggestions are termed "heuristic suggestions," and the underlying question of this dissertation is then reduced to the following particular questions: (1) Is elementary calculus a suitable medium for the presentation of heuristic suggestions? (2) Are heuristic suggestions helpful to students of elementary calculus?

Part I (Chapters II-V) of the dissertation considers the first of these questions. Chapter II discusses several heuristic ideas, based on the writings of Poincaré, Pólya, and others, and specifies a number of places where the instructor can conveniently present such suggestions to an elementary calculus class. Chapter III presents some heuristic suggestions in a form suitable for distribution to students for study outside of class, and Chapter IV shows how a wide variety of calculus problems might be organized to illustrate the role of heuristic suggestions. Chapter V discusses a number of ideas for utilizing the critical influence of grades to encourage creative effort. Taken together, these four chapters show, in the writer's judgment, that elementary calculus is a suitable medium for the presentation of heuristic suggestions.

In Part II (Chapters VI-VII), an experimental evaluation of heuristic suggestions is attempted. Chapter VI discusses an experimental comparison of three classes, one taught by the writer with a heuristic emphasis, and two "control" classes, one taught by the writer and the other by a colleague. The experiment was inconclusive with regard to the particular hypothesis that students could learn some heuristic ideas in addition to the normal course content. It did produce some evidence that students can learn to use heuristic ideas when taught from the heuristic standpoint, but indications were that such learning may come at the expense of normal course content.

In Chapter VII, an experiment is reported which shows that a particular heuristic suggestion can be a definite help to students. Two groups, closely matched in pairs, were given three problems to solve, the suggestion being appropriate for each problem. After each problem, solutions were shown to both groups. For one group, these materials emphasized the heuristic suggestion, while materials for the other group (otherwise the same) made no mention of it. The scores of the two groups were very close on all three problems, but the suggestion proved progressively helpful with respect to the time required to achieve those scores, the time differences on the third problem having a .01 level of statistical significance.

Recommendations for further research are given in the concluding chapter, and it is there suggested that future research on problem-solving may profitably make use of criteria such as times, in addition to scores, as measures of success in solving problems.

Microfilm \$3.10; Xerox \$10.80. 238 pages.

THE EFFECTS OF OPEN-CIRCUIT TELEVISION DEMONSTRATIONS OF READING INSTRUCTION ON THE OBSERVED CLASSROOM PERFORMANCES AND ATTITUDES OF TEACHERS

(L. C. Card No. Mic 61-47)

John J. Lottes, Jr., Ed.D.

The Pennsylvania State University, 1960

The Problem

It was the purpose of this research to assess experimentally the effects of a series of fifteen half-hour demonstrations of reading instruction. The demonstrations were presented "live," under simulated classroom conditions, and were televised each Saturday morning via WFBG-TV, Altoona, Pennsylvania.

Two research hypotheses were stated:

1. The television series will effect a positive change in observed classroom performances of viewing teachers.
2. The television series will effect a positive change in the attitudes toward reading instruction of viewing teachers.

The individualized approach to the teaching of reading provided the framework about which both the televised demonstrations and the criterion measures were built.

Procedure

A 2×2 factorial design was used for the experiment. The main treatment was the viewing of the series of televised demonstrations of reading instruction. The secondary treatment was the writing of weekly reports with respect to classroom procedures and professional activities related to reading instruction. The secondary treatment was designed as a "participation" variable for the purpose of assessing any "Hawthorne effects."

A supply of 213 elementary school teachers was randomly assigned to the four treatment groups.

All teachers were then measured on each of two criteria:

1. Observed classroom performance, and
2. Attitude toward the individualized approach to reading instruction.

The treatments were imposed.

Following the treatment period, scores were again obtained on each of the two criterion measures.

Separate comparisons were made between treatment groups for each of the two criterion measures. Analysis of covariance was the statistical technique used for comparing the means. Variances were examined in their own right.

Results

The results confirmed both research hypotheses. The null hypotheses of no differences between viewing and non-viewing groups were rejected at the .01 level of significance. Weekly reports had no significant effect, and there was no significant interaction between the two variables.

It must be concluded from the results obtained in this study, that the television series had real and measurable

effects on both the observed classroom performances and on the attitudes toward reading instruction of viewing teachers. Microfilm \$2.75; Xerox \$4.80. 91 pages.

**AN INQUIRY INTO THE PROPER ROLE
OF THE SOCIAL STUDIES TEACHER
WITH REFERENCE TO THE USE
OF CONTROVERSY**

(L. C. Card No. Mic 60-6062)

John Paul Lunstrum, Ed.D.
Indiana University, 1960

Chairman: Howard T. Batchelder

Statement of the problem. This study is concerned with a problem in area of normative research: the construction of a defensible set of functional specifications as a definition of the proper role of the secondary school social studies teacher in the utilization of controversial issues.

Procedures. The methods of inquiry were principally tools of logical analysis and exposition reinforced by the application of the rules of evidence for testing the validity of propositions. Seven working hypotheses -- also termed functional specifications -- were derived from a judgmental process requiring an analysis of the prevailing conditions of American society and a study of the implications deduced therefrom and applied to the role of the school.

Sources of data. The following sources of data were utilized: (1) historical, sociological, and anthropological analyses of the forces affecting education, culture, and social change, (2) interpretations of social scientists, philosophers, and professional educators concerning the problems of American society, (3) empirical studies bearing on the opinions of students, teachers, school administrators, and special interest groups, and (4) surveys or estimates of the curricula and status of teachers.

Findings. The data available pointed to the existence of competing hypotheses which may be organized under these four aspects of instructor's role: (1) the professional orientation of the teacher concerning the social function of education; (2) the professional practices of the teacher in the manner of utilization of controversial materials, and the nature and range of views contained in instructional materials; (3) the professional, community-oriented responsibilities of the teacher affecting community participation in curriculum planning, the freedom of the instructor to express an opinion in the classroom, and the formulation of policies governing the utilization of controversial issues; and (4) the professional interpretations of the proper content of the social studies curriculum.

Conclusions. The evidence obtained from the testing of hypotheses supported (as an expression of the proper role of the social studies teacher in the use of controversy) the following specifications:

1. Orientation. Recognition that the social role of education requires the critical transmission of the cultural heritage.

2. Practices. The frequent and planned use of controversial issues in the social studies curriculum.

3. Community-oriented responsibilities. (a) Freedom of teachers and the community from the demands of pressure groups in the planning of the curriculum. (b) Freedom of the teacher to express a preference in the discussion of controversial issues. (c) Formulation by representative community elements of a written policy governing the treatment of controversial issues.

4. Interpretation of the proper content of the social studies curriculum. Emphasis to be placed upon the controversial aspects of the curriculum now closed to objective inquiry.

The theory underlying the use of controversial issues as identified and appraised in this study has been substantiated in part by the following generalizations: (1) controversy is inevitable in a democratic, transitional society, (2) controversial issues encompass both individual and societal needs and thus provide a significant motivational force, (3) a dynamic, complex culture which is uncriticized perpetuates contradictions and conflicts on both interpersonal and intrapersonal levels, (4) judicious, objective treatment of sharply opposing social alternatives in a non-threatening classroom atmosphere is indispensable in the creative resolution of conflict, and (5) the manner in which the school treats controversial issues is an important measure of its conception of the social role of education. Microfilm \$5.50; Xerox \$19.35. 430 pages.

**GENERAL CREATIVITY OF
ELEMENTARY EDUCATION MAJORS
AS INFLUENCED BY COURSES IN
INDUSTRIAL ARTS AND ART EDUCATION**

(L. C. Card No. Mic 61-51)

Algalee Pool Mainz, Ed.D.
The Pennsylvania State University, 1960

The problem of this investigation was to determine whether general creativity, as it had been defined and measured by other researchers, could be enhanced through a method of teaching which had as a major aim the promotion of creativity.

In order to investigate this question, and related aspects of it, two curriculum areas, which have similarities, yet which differ in philosophy and methods, were selected to provide the population. These two areas were art education and industrial arts education. A population comprised of college students majoring in elementary education were selected, because they were outside the two disciplines yet the instruction of both areas was required in their professional preparation.

A battery of tests designated as the General Creativity Battery was administered at the beginning and end of the semester. The two groups were compared on the basis of mean gains on these measures of general creativity.

A measure of attitude, called The Uniqueness of Self Concept Attitude Check List was administered three times during the semester. Creative students have been shown to register a higher degree of self-involvement on this measure than less creative students.

A Creative Independence Performance Test, originated for this study, was evaluated objectively on the basis of independence or dependence in regard to a pre-cut stencil included in a kit of supplies from which students had the

problem of making a design. It was hypothesized that the more creative students would reject the pre-cut stencil and would cut their own, remaining free of the influence of the flower motif of the commercial stencil.

When the difference between the mean gains of the art education and the industrial arts education groups were compared by application of the "t" test, it was determined that the art education group made greater gains on all measures, and statistically significant gains at the .001 level on five of the nine measures of the General Creativity Battery. The industrial arts education group regressed on two measures of flexibility and fluency.

The students in the art education class had a greater degree of self-involvement in their projects, indicated by their statistically significant gain on the attitude measure.

A chi-square analysis pertaining to the Creative Independence Performance Test revealed a significant difference (at the .001 level) between the groups. The art education students were significantly more independent of the pre-cut stencil.

The results of this study indicate that factors of general creativity can be influenced by a method of teaching, and that a method of teaching which has as one of its major aims the promotion of creativity can effect a measurable increase in these attributes. In addition to the effect on general creativity, the art education creative approach also resulted in greater self-involvement, greater aesthetic perception, and greater creative independence.

The implications of this study go beyond the domain of art education or of industrial arts education. General creativity can be fostered; therefore, it becomes the province of all educators to promote a receptive attitude toward creativity, and to encourage every manifestation of creative thinking.

Microfilm \$2.75; Xerox \$9.45. 209 pages.

THE COMPARATIVE EFFECTIVENESS
OF CONDENSED-VISUALIZED METHODS
VERSUS TAPED-DEMONSTRATION METHODS
IN TEACHING OPERATION OF THE
VM TAPE RECORDER AND
VICTOR 16mm. PROJECTOR

(L. C. Card No. Mic 61-57)

James Robert Murray, Ed.D.
The Pennsylvania State University, 1960

Statement of the Problem

The major purpose of this experiment was to evaluate various methods for teaching the operation of the Victor 16mm. motion picture projector and the Voice of Music tape recorder. The methods were: (1) a visualized method compared with a taped-demonstration method; (2) teacher supervision of practice compared with no teacher supervision; (3) student use of laboratory guides compared with no laboratory guides.

Experimental Design

Populations

One hundred twenty women and 118 men regularly enrolled in audio-visual classes at the State College, Indiana, Pennsylvania comprised the experimental population.

Two taped lectures were prepared for both the projector and tape recorder studies. The content was based upon instructor experience, laboratory manuals, films and recommendations from audio-visual specialists. Objective and performance tests, based on methods and taped treatments, were checked for accuracy and clarity by the cooperating experimenters and the author's adviser.

The coefficients of reliability of these tests (Kuder-Richardson formula 21) are as follows: projector objective - .77; projector performance - .95; tape recorder objective - .63; tape recorder performance - .96.

Methods of Presentation

Instructor explanations were on magnetic tape for both methods.

Method 1. Condensed-Visualized - In the projector study, the visuals used were threading diagrams and the film, "Care and Operation of the Victor 16mm. Projector." Threading diagrams and a specially prepared filmstrip were used in the recorder study. In the projector study, instruction time was 30 minutes with 120 minutes of practice. In the tape recorder study, the instruction time was 16 minutes with 34 minutes practice.

Method 2. Taped-Demonstration - In this method for both studies, the explanation was on tape while the instructor demonstrated the operation of the equipment. In the projector study, instruction time was 50 minutes with 100 minutes of practice. In the tape recorder study, instruction time was 13 minutes with 37 minutes of practice.

The two major methods were subdivided into (instructor) supervision, no-supervision (self-study) and each of these in turn were subdivided into guides and no-guides. The projector study used guides and no-guides while the tape recorder study actually used charts and no-charts.

Testing

Equating of populations was based upon: (1) Form AA, Bennett-Fry Test of Mechanical Comprehension and (2) The American Council of Education Psychological Examination. These two tests correlated with the immediate performance on the motion picture projector test at the .01 level. Objective and performance tests were administered to all students during the week following their instruction period. In the projector study the performance recall test was administered six weeks after the first performance test.

Statistical Treatment

F-ratios on the performance tests of the projector study were significant at the one per cent level of confidence for supervision as compared to no-supervision.

According to the performance tests on the tape recorder, the condensed-visualized method was significantly better than the taped-demonstration method at the .025 level of confidence. The combination of teacher supervision and method was significantly better than no-supervision and method at the 5 per cent level.

Conclusions

1. All methods contributed to learning.
2. The three methods were equally effective for teaching factual information.

3. The condensed-visualized method and taped-demonstration method were equally effective for teaching the operation of the Victor 16mm. projector. The condensed-visualized method was more effective than the taped-demonstration method for teaching the operation of the Voice of Music tape recorder.
4. Teacher supervision was more effective than no-supervision for teaching the operation of the Victor 16mm. motion picture projector and the Voice of Music tape recorder.

Microfilm \$3.35; Xerox \$11.70. 259 pages.

A STUDY OF CERTAIN FACTORS RELATED TO ACHIEVEMENT IN SPELLING

(L. C. Card No. Mic 60-6817)

Bertha Morse Newton, Ed.D.
University of Missouri, 1960

Supervisor: A. Sterl Artley

PURPOSE: To discover (1) the relationship between each factor found to be a component of spelling ability and spelling achievement at a given level of learning as measured in one population sample and (2) the contributions of the most significant of these factors to the variance of spelling achievement.

METHOD OF RESEARCH: The survey-testing method of research was employed. A survey of the literature on the teaching of spelling was made to ascertain the factors which had been found positively related to achievement in spelling. A battery of tests, purporting to measure achievement in spelling and each of the sixteen factors selected for study, was administered to sixth grade children in Calgary, Alberta, Canada. Complete sets of data for four hundred cases were secured and statistically analyzed. The computations were done by IBM machine.

SUMMARY:

1. Coefficients of correlation between achievement in spelling and the related factors were obtained as follows:

a. Verbal intelligence	.68
b. Phonetic analysis	.63
c. Reading comprehension	.63
d. Reading vocabulary	.61
e. Spelling phonetic syllables	.60
f. Word derivation	.60
g. Word recognition	.55
h. Accurate pronunciation	.51
i. Visual memory	.44
j. Word meanings	.40
k. Visual discrimination	.40
l. Nonverbal intelligence	.39
m. Structural analysis	.38
n. Auditory discrimination of syllables	.36
o. Auditory memory	.35
p. Auditory discrimination	.24

These coefficients of correlation seemed to form groups according to the type of ability being investigated. The highest relationship was between verbal intelligence and spelling achievement. The group of reading and word analysis abilities was next highest; visual abilities, next highest; and auditory abilities, lowest of all.

2. Multiple correlations expressed in terms of beta coefficients and zero order r 's gave the contribution to variance made by this battery of sixteen factors to spelling achievement as 72 per cent; 28 per cent must be attributed to factors not studied in this problem.
3. The Wherry-Doolittle method of test selection yielded a combination of eight of the sixteen factors which predicted spelling achievement with maximum efficiency. These factors with the approximate amounts contributed in per cent are as follows:

Verbal intelligence	17
Spelling phonetic syllables	14
Accurate pronunciation	7
Word recognition	7
Phonetic analysis	7
Reading comprehension	7
Visual memory	7
Visual discrimination	4

CONCLUSIONS:

1. The greatest single contributor to variance in spelling achievement is verbal intelligence.
2. A relatively large amount of the variance of spelling achievement is attributable to factors not measured in this study such as interest and motivation.
3. The abilities and skills as measured in this study account for a substantial portion of the variance of spelling achievement.
4. Of the abilities and skills investigated in this problem, the ability to spell phonetic syllables is the greatest contributor.
5. The extent to which a specific factor accounts for performance in spelling does not necessarily depend upon the relationship exhibited between that factor and achievement in spelling.
6. Spelling is a complex process involving the application of several skills and abilities.
7. A constellation of abilities appears to be related to achievement in certain of the language arts areas at the sixth grade level of learning. Spelling ability, apparently, is one of this group.

Microfilm \$3.05; Xerox \$10.60. 233 pages.

THE ROLE OF THE EXECUTIVE
SECRETARY AS A MEMBER
OF MANAGEMENT

(L. C. Card No. Mic 61-426)

Honora MacArthur Noyes, Ed.D.
University of Maryland, 1960

Supervisor: Dr. Kenneth O. Hovet

The purpose of this investigation was to make an exploratory study of the woman executive secretary (defined as a secretary to a member of top management) to determine her activities as distinct from those of the woman non-executive secretary; to determine the evidences of her place in management; and from a selected sample of these secretaries to determine her socio-economic level and the behavior patterns which reflect the influence of her occupational role both on and off the job.

Data were obtained by the use of a mail-questionnaire from which returns from 211 secretaries were tabulated. Of the 211, 116 were executive secretaries and 95 were non-executive secretaries. Additional data were obtained by interviews with seventeen executive secretaries and eight non-executive secretaries, a sample selected by the use of random numbers.

The findings were that the executive secretary's median age was 42; her median salary, \$5,750. About two thirds of the executive secretaries were single. About one half had had some full time attendance at college and of that group the median number of years of college was four.

While there were no job activities from a selected list of thirty-two activities which were common to the executive secretary rather than the non-executive secretary, there were five activities which 10 per cent more executive than non-executive secretaries reported performing. These five were: handling the superior's personal banking, typing and filing confidential papers, arranging such affairs as banquets, supervising her own stenographer, and assisting the superior's family.

The conclusions were:

1. Executive secretarial work is a field for the college-educated girl.
2. The subjects that were most valuable were the traditional subjects of the secretarial curriculum as well as English.
3. Executive secretaries were for the most part experienced and mature workers.
4. A comparison of the job activities of the executive secretary with those of the non-executive secretary from a selected list of activities did not show any one activity that distinctly belonged to either group of secretaries. The outstanding difference was not one of kind but one of degree, and as secretary to a policy-making official, the effects of the executive secretary's actions were more important and far-reaching than those of the non-executive secretary.
5. The executive secretary qualified for a place on the management level because of the management functions she performed, the status symbols in her job environment, her freedoms in regard to

time, her privileges and advantages, and her close association with top management.

6. The executive secretary was likely to have achieved middle-class status in terms of her salary and living conditions.
7. Auxiliary behavior patterns that reflected the influence of her occupational role both on and off the job were likely to be shown in the executive secretary's choice of clothes, choice of friends, and in her leisure time activities.

It was recommended that in collegiate programs preparing executive secretaries at least one course in management be required and that human relations be emphasized by incorporating it in appropriate courses in the secretarial curriculum.

Microfilm \$4.95; Xerox \$17.55. 386 pages.

PRACTICES AND PROCEDURES USED
BY TEACHERS OF AGRICULTURE TO
IMPROVE PROFESSIONAL RELATIONSHIPS

(L. C. Card No. Mic 60-5246)

Charles Frank Oliver, Ph.D.
The University of Connecticut, 1960

The purpose of this study was to identify the practices and procedures used by teachers of vocational agriculture to improve their professional relations with school administrations, other local school teachers, non-governmental rural organizations, and Federal and State agricultural agencies.

Information was obtained by sending questionnaires to 1,989 teachers of vocational agriculture who had been in their positions for at least three years. These were chosen by an approximate twenty per cent random sample by States. Useable replies were received from 727 men representing 7.2 per cent of all the teachers of vocational agriculture in the United States.

Of the thirty-five items listed in the questionnaire dealing with school administrators, seventeen were found to be used regularly by fifty per cent or more of the respondents. The nine showing the highest percentage of use were: be regular in attendance at faculty meetings, handle all school matters through proper channels, know your administrator and act accordingly, handle own disciplinary problems effectively, be informed on policies of the school system and follow them, take an interest in all phases of the school program, always keep the principal informed as to where you are, make the department an integral part of the school, and keep them informed of the work of the department.

Fourteen of the thirty-four items dealing with other teachers were used regularly by fifty per cent or more of the respondents. Seven of them were used by seventy per cent or more. These were: attend all faculty meetings regularly, avoid as much as possible conflict with other school activities, inform teachers in advance when vo-ag boys are to be absent, be an active member of the local teachers' organizations, carry a fair share of extra-curricular duties, make vo-ag department an integral part

of the total school program, encourage vo-ag students to participate in other school activities, become acquainted with new faculty members as soon as possible.

None of the sixteen practices and procedures in the questionnaire dealing with non-governmental rural organizations were used regularly by fifty per cent of the respondents. Only four of them were used by more than thirty-three per cent of the men. These were: become acquainted with affairs and policies of organizations, join them when feasible, encourage students to join various organizations, have students participate in their contests.

Of the fourteen practices and procedures in the questionnaire dealing with Federal and State agricultural agencies only three were used regularly by fifty per cent or more of the respondents. These were: ask to have the vo-ag department put on the mailing list of various agencies, become acquainted with heads of various agencies, encourage vo-ag groups at all levels to make use of services of various agencies.

The Chi-square test for significant difference of use was applied to all ninety-nine items in the questionnaire. Sixteen of the thirty-five items were with school administrators, twelve of the thirty-four items dealing with other teachers, fourteen of the sixteen items dealing with rural organizations, and twelve of the fourteen items dealing with agricultural agencies showed some significant difference at either the one, two or five per cent level in the various Regions. When the Eastern Region VI and the Western Region I were tested, twenty-five items showed significant difference.

Microfilm \$2.75; Xerox \$7.60. 162 pages.

**A STUDY OF THE USES OF
SOCIOMETRIC TECHNIQUES FOR
FORMING INSTRUCTIONAL GROUPS FOR
NUMBER WORK IN THE FIFTH GRADE**

(L. C. Card No. Mic 61-429)

John A. Schmid, Jr., Ed.D.
University of Maryland, 1960

Supervisor: Professor Fred R. Thompson

This study concerns itself with investigations of the effectiveness of the sociometric technique for grouping pupils for their number work (arithmetic) and with the uses of the sociometric technique to measure certain socialization processes among the children as these processes are related to the instructional program. Stretching through the school year 1959-1960, the study involved the fifth grade classes in a large elementary school in Baltimore. There were two "control" classes in which the usual program was not touched and two "experimental" classes wherein the program was modified to the extent that for number work and playtime activities the groups used in the classes were formed on the bases of the sociometric choices of the children.

In September the children were given standardized intelligence, reading, and arithmetic tests as part of the regular city-wide testing program. The arithmetic test was administered again in June to the classes involved in the study. The other data were obtained through observations and recordings in the classrooms.

Three hypotheses were set up for exploring the implications of the sociometric procedures for the instructional program:

- H₁ The children will achieve more, as measured by standardized tests, in groups they choose for themselves than they will achieve in teacher-formed groups.
- H₂ Children in number work groups formed by their own choices will have a wider range of scores on standardized tests than the children in groups formed by their teachers on the bases of diagnostic tests and the needs evidenced by the children in their daily number work periods.
- H₃ The children working in groups of their own choice will be more responsive than children working in teacher-formed groups.

The statistical tests of the data suggested homogeneity of variances and means for all of the initial tests of the criterion variables. There were significant differences in the mean scores on the final tests in June. The superior performances were associated with the children who had been grouped via the sociometric technique. H₁ was accepted for this group of children. H₂ and H₃ also were accepted as the statistical tests indicated significant differences between the classes with wider ranges and greater responsiveness being associated with the children using the sociometric grouping technique.

Three hypotheses were set up for exploring the implications concerning certain socialization processes among the children.

- H₁ The choices for number work groups will follow the sub-culture patterns of the classes.
- H₂ There will be significant agreement between the children's choices for number work companions and their choices for playtime companions.
- H₃ There will be consistent patterns in the children's choices of number work companions.

The Negro-white sub-culture patterns were selected for the investigation of H₁ and the hypothesis was accepted. H₂ and H₃ were accepted on the bases of statistical treatment strongly supported by the empirical evidence.

The implications concomitant with the acceptance and rejection of the respective hypotheses were discussed. The results of the study suggested the advisability of further exploring the sociometric technique for forming teaching groups in arithmetic and other areas in the elementary curriculum, the needs for more action research better to establish and assess the desirability of the procedures, and the needs to control and measure the variables in such research; namely teachers, Negro-white pupil ratios, and the teaching procedures. The extent to which the results of this study might generalize to other children is dependent on their similarity to the sample studied. Additional investigations of these relationships in other classes of children in other schools would be needed to confirm or negate the findings.

Microfilm \$2.80; Xerox \$9.90. 216 pages.

EFFECT OF ADDING THE
PROBLEM SOLVING PROJECT TECHNIQUE
TO A LECTURE LABORATORY METHOD
IN TEACHING COLLEGE BIOLOGY

(L. C. Card No. Mic 61-68)

Jack Russell Snyder, Ed.D.
The Pennsylvania State University, 1960

The growth in knowledge of biology for 95 college freshmen was studied from September, 1959, to May, 1960. The population was divided into two statistically matched groups for the purpose of comparison to determine the relative effects the introduction of a Problem Solving, Project technique to the traditional Lecture-Laboratory method of teaching would have upon the learning of biology. The experiment consisted of a comparison of differences in scores resulting from two equivalent forms, X and Y, of the Cooperative Biology Test. Form X was used as a pre-experiment test, and Form Y was used as a post-experiment test. Statistical analysis using the t-ratio showed little superiority for the experimental method as a whole. Two sub experiments were of statistical importance at the 5% level of confidence. First, there was an indication that more biological facts than biological principles were learned by students who were taught by the experimental method. Second, the higher-ability students seemed to profit more from the experimental method than the lower-ability students.

Microfilm \$2.75; Xerox \$4.20. 77 pages.

PHILOSOPHIES OF AUDIO-VISUAL
EDUCATION AS CONCEIVED IN
A UNIVERSITY CENTER AND
BY SELECTED LEADERS

(L. C. Card No. Mic 60-6076)

Francis Ashe Thomas, Ed.D.
Indiana University, 1960

Chairman: James Q. Knowlton

Purpose. Most college audio-visual programs have been influenced in their development by expediency more than theory. The conceptual change from pre-occupation with materials, to their integration into the curriculum, to a communications orientation (where concern is with audience characteristics and communication effects), represents a transition that has not been generally assimilated by the staffs of many audio-visual centers. An examination of presently held views and a study of some of the historic controversies found in the literature were thought to provide one avenue toward the solution of conflicting viewpoints.

Problem. This study is concerned with a description of the philosophies of (1) selected leaders in the audio-visual field, (2) graduate students in Audio-Visual Communication at Indiana University, and (3) the philosophy of the Audio-Visual Center at the above university.

Method. A questionnaire was developed around controversial issues found in the literature and as revealed in conversation with audio-visual personnel in teacher

education, research, communication, etc. A funnel-type questionnaire was used to interview seventeen leaders in the audio-visual field selected on the basis of peer recognition, professional activities, and/or outstanding programs; to a sample of seventeen audio-visual graduate students at Indiana University; and to the Director of that university's Audio-Visual Center.

Conclusions

1. Although audio-visual leaders have achieved a shift of emphasis from service and materials to the function and utilization of materials, and more recently to a communication-theory orientation; this shift has not always been made, and it has often been resisted.

2. The audio-visual leaders were concerned that curriculum and instruction be more effectively organized. They were concerned with the professionalization of the field; and with the achievement of wider utilization. However, few thought that more extensive consolidation of areas within the field would achieve these goals.

3. Leaders in the field agreed that a more favorable attitude toward the utilization of audio-visual materials was necessary. While the field could benefit from more theoretical research, graduate research should be of a more practical nature, but should not stress comparative media studies which, it was thought, had been over-done.

4. Controversial issues concerned the desirability of a communication orientation; the relation of the audio-visual center to other university departments; the content and direction of the graduate and undergraduate program; and the advisability of limiting the audio-visual offering to what may be contained in integrated courses.

5. Both the graduate students and the Director of the Indiana University Audio-Visual Center shared the belief, gradually gaining acceptance elsewhere, that a communication orientation is necessary in insuring optimal growth of the audio-visual field.

Implications

1. Three sharp levels of interest exist within the audio-visual field. The first consists of a rapidly disappearing group concerned primarily with the amount of audio-visual materials used. The second, a curriculum-functional group, is most likely to be strong in the small college; while the larger university is more likely to contain the third or communication-oriented group. Difficulties of communication may exist between these latter two groups.

2. A post-doctoral research communication school seems a distinct possibility.

3. A second possibility is that doctoral candidates from various departments of the university (including audio-visual communication) will in the future engage more in inter-disciplinary research.

4. The demand for doctoral candidates in audio-visual communication by other university departments for purposes of aiding in visualization is likely to be a growing part of the internship program.

5. Communication theory appears likely to aid in the solution of problems of organization of university audio-visual centers.

Microfilm \$2.85; Xerox \$9.90. 219 pages.

AN ANALYSIS OF NINETY-SIX
ELEMENTARY SCHOOL CHILDREN'S
RESPONSES TO FIFTEEN SELECTED PAINTINGS

(L. C. Card No. Mic 60-6644)

Mildred Burl Vance, Ed.D.
The University of Texas, 1960

Supervisor: Dr. Henry J. Otto

This was an exploratory study in which a new approach was used in examining how children at different age levels related themselves to reproductions of famous paintings. In the past, famous pictures had been used in teaching art appreciation by telling children what they should see and appreciate about famous pictures; that which children should see and appreciate was decided by adults on the basis of adult concepts about art. In the present study an effort was made to find out what children saw in the pictures, without the prescription or prompting by adults. The writer tried to find out "what pictures said to children." In order to get such a "children's look" at famous paintings, fifteen reproductions of famous paintings were selected and a time-consuming individualized interview technique was developed.

Ninety-six elementary school children were asked to respond to each of the fifteen paintings. There were twenty-four children from each of the following grade levels--kindergarten, second, fourth, and sixth--and an equal number of boys and girls from each level.

The responses were classified into three major types: kinesthetic, emotional, and verbal. The kinesthetic responses included motor activities that appeared to be related to communication reactions. Any motor action that seemed to clarify ideas, such as gesturing, pointing, tracing, etc., were considered kinesthetic responses. The emotional responses were those revealed to the investigator, such as laughing, smiling, gritting teeth, biting lips, and deep breathing. The verbal responses consisted of the oral language that the children used when they revealed their thoughts about the paintings. The kinesthetic and emotional responses were recorded by checking an observation chart designed for this purpose. A tape recorder was used to ascertain the verbal response of the children.

The analysis of variance technique was used to establish significance of relationships between the variable factors considered in the study. A 4 x 3 x 2 x 3 design was used. Included in this design were the following variables: four grade levels, three achievement levels, two levels for sex, and three types of paintings--abstraction, expressionism, and realism.

In the analysis of the kinesthetic responses a significant effect was found in several of the variables. The children in the kindergarten showed a significantly greater number of kinesthetic responses than did the children of the fourth and sixth grades at the one per cent level. The number of kindergarten responses were significantly greater than at the second grade at the five per cent level. There were no significant differences among the means of the fourth, sixth, and second grade responses. The means chart for responses to paintings showed that abstraction elicited the greatest number of kinesthetic responses. The mean number of responses to abstraction was significantly greater than the number of responses for realism and expressionism, both at the one per cent level.

In the analysis of the emotional responses, the responses to expressionism were significantly more numerous than the responses to either abstraction or realism at the one per cent level. The number of responses to abstract paintings were significantly greater than the number of responses to realism at the five per cent level. The data indicated a larger number of emotional responses from the older children than from the younger children.

In the analysis of verbal response (number of words), only achievement by grades showed a significant effect at the five per cent level. The second grade children were the least verbal. No significant differences were found among the means of the verbal responses to the three types of paintings.

The verbal data were also analyzed for the expressions of concepts. The types of concepts considered in the analysis were: mathematical, time, science, self, social, aesthetic, humor, and miscellaneous. Social concepts were revealed the greatest number of times, scientific next, and aesthetic next. Mathematical concepts and self concepts were expressed the same number of times. Paintings appear to children as a serious undertaking rather than humorous.

Generally speaking, expressionism appears to be the best type of painting to use in the elementary school, and abstraction seems to be the best to use with kindergarten children. This study had a limited number of subjects participating; therefore, the conclusions may not be valid for the general population of children.

Microfilm \$2.75; Xerox \$7.40. 159 pages.

EDUCATIONAL FACTORS THAT
INFLUENCE DECISIONS TO PRODUCE
INSTRUCTIONAL FILMS

(L. C. Card No. Mic 60-5125)

Alfred Lawrence Villa, Ed.D.
Boston University School of Education, 1960

Problem: The purpose of this study was to identify and to assess the relative importance of educational factors that influence the decisions to produce instructional films. It was the further purpose of this study to determine whether any significant differences exist for these educational factors between films that are most frequently requested and least frequently requested from film libraries.

Procedure: Fifty-five of the sixty college and university film libraries in the United States with over 1,000 titles were surveyed. As a result of the survey, 372 most frequently requested film titles and 484 least frequently requested film titles were identified. Films were eliminated from these titles if they were (1) produced prior to 1946, (2) produced for other than school use, or (3) reported by less than two libraries. When the ninety-six films that remained were matched according to producer as well, forty-two films were left in the final sample.

A checklist of educational factors was constructed and used in tape-recorded interviews with representatives of film producers who participated in the decision to produce each of the films under study. To assess reliability of the sources of data, the interview for approximately each fourth

film was followed up by a second and separate interview with another person who shared in the same decision to produce. To assess reliability of interpretation, each tape-recorded interview was analyzed by two people. These reliabilities were determined from measures of absolute value and measures of direction of difference.

Educational factors on the checklist were given a score from the responses to both categories of films. Those factors whose scores exceeded the mean for their division on the checklist as well as the mean of all the factors on the checklist were identified as influential educational factors. Comparisons were made for each factor between the two groups of films by means of the Chi Square technique. The significance of each comparison was tested at the .05 level.

Findings: Twenty-two factors were identified as influences in the decision to produce the instructional film. In rank order they were:

Rank	Factor
1	Textbooks
2	Courses of study
3	Representative schools
4	Class grouping by age
5	Curriculum programs
6	Reports by your consultants
7	Consultants affiliated with you
8	Academic subject areas
9	6-3-3 or 6-6 organization
10	Publications concerned with subjects
11	Coeducational class grouping
12	Instructional films
13	School supervisors
14	National associations
15	Secondary teachers
16	Urban school population
17	National meetings or conferences
18	Teacher polls
19	Individual expressions of experts
20	Guidance programs
21	Other (miscellaneous)
22	Regional meetings or conferences

Factors listed above were associated with the following major divisions of the checklist: Materials and activities (factors 1, 2, 5, and 12); Expert opinion (factors 6, 10, and 18); Curricula (factor 3); General objectives of education (factors 14, 17, 19, and 22); Administrative and organizational patterns (factors 8, 9, 20, and 21); Curriculum research (factor 7); Audience characteristics (factors 4, 11, and 16); Educational concern (factors 13 and 15).

The following two factors were significantly different between the most frequently requested and least frequently requested film groups:

1. Textbooks - associated with: Materials and activities.
2. Reports by your consultants - associated with: Expert educational opinion.

There were no significant differences for any other factors on the checklist.

Conclusions: Of the ten divisions of educational factors on the checklist, film producers appeared to be influenced more by factors related to: Content of educational

materials and activities (kinds); Expert educational opinion (sources); Statements of general objectives of education (sources); Administrative and organizational patterns (kinds); Characteristics of a potential audience (kinds); and Current educational concern (sources).

Film producers appear to be less influenced by educational factors associated with: School curricula (kinds); Proposed film specifications (sources); Evaluative instruments or techniques (kinds); and Curriculum research (sources). Microfilm \$2.75; Xerox \$9.25. 204 pages.

THE SECONDARY SCHOOL IN KENTUCKY AS REVEALED BY THE USE OF THE EVALUATIVE CRITERIA

(L. C. Card No. Mic 61-309)

Pat Waterfield Wear, Ed.D.
University of Kentucky, 1956

Director: Dr. Frank G. Dickey

With the conclusion of over a decade of evaluation of Southern Association secondary schools in Kentucky through the use of the Cooperative Study of Secondary School Standards Evaluative Criteria, 1940 Edition, and accompanying procedures, the time seemed appropriate for an investigation of the characteristics and nature of the secondary school in Kentucky as revealed by the use of this evaluation instrument and the related processes.

The first major phase of this study dealt with the summarization of the final evaluations as determined by the school staff and modified by the visiting committees on each aspect of the school program obtained from Summary Form X records for 115 schools, evaluated between January, 1940 and September, 1951. The schools were categorized as follows: public white, private, public Negro and by enrollments: 0-199, 200-499, 500-999, and 1,000 and over. These categories were established in an attempt to determine whether there were any relationships existing between the adequacy of the school program and a particular category.

A second major aspect of the study was to survey changes made in the evaluated secondary schools of Kentucky and to secure the opinions of the schools regarding the use of the Evaluative Criteria and the accompanying processes through a two-part questionnaire. This questionnaire entitled "Changes Made In The Secondary Schools Resulting From Recommendations Made By Visiting Committees" was constructed in such a manner that each of the 116 schools studied served as a special case. Part I of the questionnaire contained questions that were derived from the final recommendations of the visiting committees to the schools evaluated. Part II of the questionnaire was based on ten questions designed to gain the opinions of the school staffs as to the values, procedures, techniques, and leadership roles involved in the use of the Evaluative Criteria in appraising schools.

Primary results of this study have provided data indicating: (1) many changes have been made in the Southern Association secondary schools of Kentucky growing out of the use of the Evaluative Criteria; (2) there are few strengths, much "averageness," and many weaknesses

in the secondary schools as revealed through the final ratings given by the evaluating committees; and (3) the major characteristic of the secondary school in Kentucky at mid-century is that of educational mediocrity.

Further significant findings of the study indicate:

(1) that evaluation in the Southern Association and in Kentucky is conceived of as being primarily for self-improvement of schools and should be continuous, flexible, and more qualitative; (2) the evaluation findings have been used primarily by the faculties involved in a rather informal manner; (3) the newspaper was the chief medium through which evaluation findings were publicized, but generally too little formal reporting to the public has resulted; (4) evaluations could have been made more effective by more careful selection and use of the visiting committee and its procedures and by a more thorough orientation of the faculty regarding procedures and purposes of evaluation; (5) the role of the State Department of Education was conceived to be that of providing active, cooperative leadership in the total process and to provide consultive aid particularly in follow-up activities; (6) the University and the state colleges are expected to furnish leadership, consultants, specialists, committee members and other field services when called upon; (7) the strongest features of evaluations using the Evaluative Criteria, were the self-evaluation phase, the disturbing of complacent attitudes of those in school communities, the bringing into focus of educational problems and the providing of motivation for improvement; (8) the weaknesses of the evaluation process using the Evaluative Criteria were that the time period spent by the visiting committee was too short, follow-up processes failed, and that some visiting committee personnel seemed lacking in proper training and experience; (9) and finally there is existent generally a very favorable attitude toward further evaluation on the part of the schools of Kentucky involved in this study.

Microfilm \$4.30; Xerox \$15.30. 336 pages.

SOCIOLOGICAL BASES OF INDUSTRIAL ARTS FOR SECONDARY SCHOOLS

(L. C. Card No. Mic 60-6684)

William Arthur Wockenfuss, Ed.D.
The University of Florida, 1960

The purpose of this study has been to propose a conceptual basis for developing an industrial arts program. The major hypothesis is that the bases of the industrial arts program are sociological rather than narrowly technological. The implied assumption is that heretofore the industrial arts program has been based mainly upon technological considerations with little, if any, emphasis upon the sociological.

Data have been gathered through analysis of the five elements of society used widely by sociologists in the study of society: demography, including composition of the population, fertility and mortality, and migration; social morphology, including ecology, groupness, and stratification; social processes, including cooperation and opposition, social adjustment, and social mobility; social institutions, including the family and education; and social change, its nature and effects. The sources of data have

been, in the main, the major writings of widely accepted authorities in each of the areas. From the analysis, significant facts have been pointed out and their implications for industrial arts education indicated. Criteria for the selection of the facts are conditions and situations which have changed (1) the behavior and structure of groups and (2) a portion of the culture. The implications have been synthesized into guiding principles for the development of an industrial arts program consonant with the sociological bases upon which it must rest.

Briefly, the support of the hypothesis is as follows: Industry is a social institution, an organization for the production of goods and services. As a cultural item, industry affects the behavior of the members of society. Since industry does seek to change the culture deliberately, it changes the structure and behavior of society. Through specialization and division of labor, the culture of industrial society has been able to develop to huge proportions. Industry and the industrial economy are cultural developments which are designed to advance the culture and to distribute benefits of the development among the members of society.

Because the culture of society is so large, the public school system has evolved to transmit those segments of the culture which are deemed important by society. The industrial arts program, as part of the formal education system, must provide students with experiences which foster an understanding of the social institution of industry. It must foster an understanding of the interrelatedness of industry in the society.

From the significant facts drawn from the analysis of the American society and the implications they have for the industrial arts program, certain guiding principles have been formulated. The principles are of two distinct types: (1) those which help clarify the role of industrial arts in general education and (2) those which influence the subject matter content as a field of specialization.

As part of general education in secondary schools, the industrial arts program must: (1) be available to all students regardless of race, sex, color, or place of residence; (2) help students to become more communicative in the realm of industry; (3) serve the guidance program of the school; and (4) foster an understanding of the interrelatedness of industrial society. As a field of specialization, the industrial arts program must continue to study the tools, materials, processes, and products of industry. In addition, it must help students to understand (1) industry as a social institution, (2) the occupations of industry, (3) health and safety practices of industry, and (4) industrial labor relations.

Microfilm \$6.35; Xerox \$22.50. 500 pages.

**A STUDY OF THE RELATIONSHIP
OF EXTENSIVE READING TO CERTAIN
WRITING SKILLS OF A SELECTED GROUP
OF SIXTH GRADE CHILDREN**

(L. C. Card No. Mic 61-289)

Nita Mae Wyatt, Ed.D.
University of Kansas, 1960

1. Statement of the Problem. Writers in the field of language education disagree among themselves about the contribution of reading to writing abilities. There is agreement among these authors that the language arts are interrelated, but the significance of specific interrelationships for the teaching of the language arts is not clearly understood. The purpose of the present study was to determine whether a significant relationship could be found to exist between the amount of voluntary reading done by a selected group of sixth grade children and their abilities in six facets of writing.

2. Procedure. The amount of reading done and the writing abilities of three groups of children were studied. The children within each group were comparable in intelligence, age, reading ability, and number of years enrolled in the school system in which the study was done. Group A was composed of 21 children whose intelligence quotients ranged from 126 to 140 and whose reading achievement scores ranged from grade level 9.6 to grade level 11.0. Group B, which was composed of 21 children, had an intelligence quotient range from 111 to 125 and a reading achievement range from 8.1 to 9.5. Group C, which was composed of 23 children, had an intelligence quotient range from 95 to 110 and a reading achievement range from 6.5 to 8.0. All of the children had been in the school system at least two years and all of them were between 10 years, 9 months and 11 years, 9 months of age.

The amount of reading done was determined from questionnaires completed by the children and from the records of the Kansas Reading Program for Children. Each of the four compositions written by each child was analyzed and scores were determined for usage, spelling, capitalization, punctuation, vocabulary, and sentence structure.

Rank order correlations were computed for each group between scores on each of the writing factors and amount of reading done.

3. Findings and Conclusions. There was no conclusive evidence from the present study that there was or that there was not a significant relationship between the amount of reading which a child had done and his writing ability in the factors considered in the study. There were isolated significant correlations, but none which were significant for all three of the groups.

A significant correlation was found between the amount of reading done and ability to spell unusual words for one of the groups. Further investigation is needed to substantiate such a correlation. The provision of time for much free reading may be indicated as a method of improving children's abilities to spell uncommon words.

There seemed to be a direct relationship between intelligence and achievement on five of the six facets of writing which were studied.

The evidence from the study tended to support rather than to repudiate the conclusions already reported in the

literature that children in the intermediate grades write better compositions about vicarious experience than they do about direct experience.

A high degree of proficiency in one language area did not signify a high degree of proficiency in another for an individual child in the study. Some of the children who read the most had the least skill in writing. Some who did well in one facet of writing did not do well in another. Teachers need to be aware of the proficiencies of each individual in order to teach the language arts effectively.

Microfilm \$2.75; Xerox \$7.20. 152 pages.

**A PROCESS CONCEPTION OF
PSYCHOTHERAPY AS APPLIED TO
A GROUP OF HIGH SCHOOL STUDENTS**

(L. C. Card No. Mic 60-5818)

Thad Orlo Yost, Ed.D.
Boston University School of Education, 1960

The purpose of the study was to test the hypothesis that the stages of personality changes identified by Rogers¹ as being present in client-centered psychotherapy are also identifiable in varying degrees in individual members of a small group of sophomore high school students participating in group-centered psychotherapy. The study was based on the assumptions that

1. High school students who are disturbed can benefit from group therapy.

2. Responses of individuals participating in group-centered therapy are indicative of personality growth and can be identified by judges with one of the seven stages in the process of change described by Rogers.

3. The stages identified by Rogers in client-centered psychotherapy are identifiable in varying degrees in group-centered psychotherapy, and this method of counseling can be successfully used by school counselors in the present setting.

Study procedures included the selection of a group of seven boys and girls from among 324 sophomore high school students who were willing to participate and who showed evidence that they could benefit from group counseling. Twenty therapy sessions were held and recorded. Six selected sessions were transcribed and presented to five judges, who rated the group members' individual responses on the basis of the seven stage process scale. These ratings were analyzed with the following results:

1. Interrater reliability of the five judges based upon all responses rated by three or more of the judges resulted in an average correlation of .62 which is significant at the .01 level.

2. Seventy percent of the rated responses were agreed upon by three or more judges.

3. The rated responses of the members of the group were significantly higher on the process scale at the end than at the beginning of therapy and a greater proportion of the group member's responses were rateable in later sessions than in earlier sessions. This was interpreted to mean that some type of growth was made by individuals in the group.

It was concluded that the stages identified by Rogers in individual psychotherapy were identifiable in varying degrees in the group studied and that group-centered

psychotherapy as herein defined was a useful technique in this high school setting.

1. Carl R. Rogers, Richard A. Rablen, and Alan M. Walker, "Development of a Scale to Measure Process Change in Psychotherapy," Unpublished Paper, University of Wisconsin, 1958.
Microfilm \$2.75; Xerox \$8.60. 187 pages.

**A COMPARISON OF ACADEMIC ACHIEVEMENT
AND SOCIAL ADJUSTMENT OF PRIMARY SCHOOL
CHILDREN IN THE GRADED AND NONGRADED
SCHOOL PROGRAMS**

(L. C. Card No. Mic 61-76)

John Richard Zerby, Ed.D.
The Pennsylvania State University, 1960

A comparison of academic achievement and social adjustment of primary school children in the graded and nongraded school programs.

This study was made to determine whether the non-graded primary school organizational plan produced a more advanced academic achievement level and better social acceptance among pupils than did the graded school organizational plan. Educators around the country have been searching for a school organizational plan that more adequately meets the educational needs of the individual child.

In order to ascertain comparative achievement levels and social acceptance of pupils, tests were made of students receiving instruction under each plan at the end of the primary period. An examination was made of the school programs, faculty, and the socio-economic classification of the communities used in this study.

The tests used as a basis for making comparisons of anticipated and actual achievement levels were the Kuhlmann-Anderson Intelligence Test and the California Achievement Test. A Sociometric Measure was used to assess social acceptance.

It was found that achievement levels of students as measured by the California Achievement Test showed that the nongraded school pupils achieved at the following levels in comparison to graded school pupils in:

Arithmetic Fundamentals	= +.70 months
Arithmetic Reasoning	= +.35 months
Spelling	= +.30 months
Reading Comprehension	= +.30 months
Mechanics of English	= +.20 months
Reading Vocabulary	= +.00 months
Total Average	= +.31 months

An examination of the total results revealed that at the end of the third year the nongraded primary school plan produced pupil achievement levels which averaged nearly eight school months in advance of anticipated achievement levels. The graded primary school pupils exceeded the anticipated achievement level by nearly five months. Even though the measures of intelligence favored the graded school, the nongraded pupils' achievement level exceeded the graded pupils by an average of three and one-tenth months (+.31). This study showed that at least an additional month's growth for each of the three school years was made under the educational plan which keeps groups of pupils under the same teacher's guidance for the entire primary school years.

The results of the sociometric measures were similar for both schools studied. No difference in favor of the nongraded school was found in the results. However, a smaller percentage of "isolates" was found in the non-graded school.

In an examination of the school programs, faculties, and the socio-economic classification of the nongraded and graded primary schools, the results favored the graded school. The results of this study indicated that these factors did not necessarily affect achievement levels.

Teachers and administrators should undertake studies dealing particularly with the effect of the three-year association of teacher and student, student and student, and parent and teacher. This study should determine whether the extended relationships of this kind have a favorable effect on the individual growth of students both academically and socially.

Microfilm \$2.75; Xerox \$6.80. 141 pages.

ENGINEERING

ENGINEERING, AERONAUTICAL

HYDRODYNAMIC STABILITY AND TRANSITION OF THE BOUNDARY LAYER

(L. C. Card No. Mic 61-36)

John Arthur Fox, Ph.D.
The Pennsylvania State University, 1960

The geometry of quasi-parallel and yawed cylinder boundary layer flows is investigated to determine the assumptions inherent in using the Orr-Sommerfeld stability equation for such flows. As is demonstrated, use of the Orr-Sommerfeld equation for such flows physically implies that terms multiplied by the curvatures of the laminar flow field must be negligible; for flat plate and yawed cylinder boundary layer flows, the largest curvatures are of the order of one over the Reynolds' number and hence in the region of interest may be considered small, thus justifying the use of the equation.

Since the Orr-Sommerfeld equation is exact only for parallel flows, the stability of laminar mixing of jets is considered only at infinite Reynolds' number where these flows are parallel. A Taylor series method of solution is developed about the inviscid neutral point for the phase velocity as a function of the wave number and reciprocal of the Reynolds' number. This series provides a means of determining the stability curves at high Reynolds' number. Extensive integrations using initially the slopes calculated for the Taylor series indicate that the lower branches of the stability curves for jet flows are probably asymptotic to the zero wave number (frequency) axis.

Finally, a method of relating transition of the boundary layer to the growth of initially small disturbances is proposed. The method suggests the use of the mean motion and mean disturbance energy equations for determination of the amplification of the disturbances and mean equilibrium velocity profiles. From recent experimental evidence, the minimum harmonic requirements are deduced and the equations needed to determine the disturbance shapes are given. The experimental work necessary to establish the parameters needed in the method of solution is also indicated. In this transition study, it is concluded that several harmonics of the wave motion must be considered. All equations are derived for the necessary calculations.

Microfilm \$2.75; Xerox \$5.20. 104 pages.

ENGINEERING, AGRICULTURAL

EFFECT OF HUMIDITY ON HEAT AND VAPOR DISSIPATION OF HOLSTEIN COWS AT 65, 80, AND 90 F.

(L. C. Card No. Mic 60-6786)

Burton F. J. Cargill, Ph.D.
University of Missouri, 1960

Supervisor: Robert E. Stewart

It was the purpose of this study to investigate the effect of temperatures and relative humidity 20-80% RH on total heat and vapor dissipation from lactating cows in an environment-controlled test room. Other phases of the study were to investigate effects of temperature and relative humidity on milk production and feed consumption as they are related to heat and moisture dissipation and to correlate the results to improved criteria for summer dairy shelter design.

The Climatic Laboratory, at the University of Missouri, was used to accomplish the objectives of this study. Two groups, six Holsteins each, were alternately subjected to experimental and controlled conditions to study effect of humidity and temperature on total heat and vapor dissipation and milk production. The experiment lasted 36 weeks and the experimental design was such that normal milk production decline could be calculated and compared over the entire period.

Instrumentation enabled the determination of psychrometric properties needed to compute total heat and vapor exchange from test room air. Exchange measurements were corrected to represent only total heat and vaporization from animals and surrounding surfaces.

Results of this study related effects of temperature and humidity on Holsteins. As air temperature increased from 65 to 90 F, total heat dissipation decreased and vapor dissipation increased. Humidity (20 to 80% RH) affected total heat and vapor dissipation.

Higher humidities, at a given temperature, decreased total heat and vapor dissipation. At a constant humidity, less total heat was dissipated at 90 F than at 80 F but more total vapor was dissipated at 90 F than at 80 F.

Air temperature from 65 to 90 F decreased feed consumption. Increased feed consumption, at a given temperature, slightly increased total heat and vapor dissipation. Air temperature effect, at a constant feed consumption, was significant on total vapor dissipation. Vaporization more than doubled from 65 to 90 F.

Milk production had a minor effect on total heat dissipation. Air temperature, at a given milk production, had a significant effect on vaporization. At 30 pounds milk per cow per day, total vaporization at 65 F was 1.25 pounds vapor per hour per 1000 pound body weight; at 90 F it was 2.66 lb/hr.

A human comfort index was investigated on the supposition that the dairy cow was affected by the same climatic factors which caused human discomfort. The Weather Bureau discomfort index, which relates dry- and wet-bulb temperature was selected. The Weather Bureau reported that 100 per cent of the population were uncomfortable at 79.

This study indicated that at a discomfort index of 76 to 77, milk production declined one standard deviation from the normal milk production curve. Therefore, an index of 75 is considered a safe design criterion for environment-controlled summer dairy shelter.

Results of this study can be directly applicable to the summer shelter requirement for Holsteins. Two basic criteria are essential for economical summer shelter design: (1) range of temperatures and humidity conditions for optimum production, and (2) total air-conditioning load imposed by animal and shelter.

Based on a discomfort index of 75, the optimum range of summer conditions is from 77 F-80% to 90 F-15% RH; total heat dissipation would be 2730 Btu/hr/1000 lb body weight at 80 F and 2908 Btu/hr at 90 F, and total vapor dissipation would be 1.91 lb/hr at 80 F and 2.67 lb/hr at 90 F. These values establish the predicted air-conditioning loads.

Microfilm \$2.75; Xerox \$7.40. 160 pages.

PHYSICAL FACTORS INFLUENCING MIXING IN BULK MILK TANKS

(L. C. Card No. Mic 61-443)

Floyd Mitchell Cunningham, Jr., Ph.D.

Iowa State University of Science and Technology, 1960

Supervisors: Leon F. Charity and Glenn Murphy

Insufficient information has been available on which to base the design of mechanical agitation equipment for bulk milk tanks. The objective of this study was to investigate the influence of certain parameters describing the liquid, agitator and tank upon the agitation time required to obtain uniform mixtures of butterfat and milk serum.

An experimental approach with models was used. To simulate milk, an oil in water emulsion containing 5 per cent oil by volume was prepared with a colloid mill. With consideration for Reynolds and Froude similarity, the kinematic viscosity of the emulsion made it possible to use model tanks and agitators whose physical dimensions were one-half those of their prototypes. For the range of agitator velocities studied, it was assumed that the influence of possible dissimilarities of forces involved in the clustering of the oil globules and in the clustering of butterfat globules would be negligible.

Rectangular glass tanks with widths of 14.6, 20.6 and 29.1 inches were studied. Except for some tests in the widest tank in which a movable partition was used to vary the effective tank length, all tanks had a length to width ratio of 1.41. Emulsion depths from 6 to 12 inches were studied.

Rectangular agitator paddles of various sizes were used in the investigation. In addition to operating the agitator paddles in the center of the liquid contained in

the tanks, various amounts of horizontal and vertical off-centering were used in the largest model tank.

To permit stratification of the oil, a one-hour time interval was used between mixing tests. To determine the uniformity of mixtures, oil concentration of the emulsion was measured using a probe with parallel wire electrodes and an alternating current bridge with Brush recording equipment. The agitation time for mixture uniformity was taken to be the agitation time required for the oil concentration measurement to differ by not more than ± 0.19 percent oil from the mean value for the entire tank.

The chief conclusions drawn from the study are:

1. For the low levels of agitation used in bulk milk tanks, viscosity and gravity appear to be important factors influencing the mixing. To definitely establish the degree of importance however, further investigation of the influence of interglobular bonding tension is needed.

2. Agitation time requirements in the 2 to 3-minute range are closely correlated with paddle tip velocity for a wide range of tank sizes and agitator arrangements, provided that paddle width relative to tank size is sufficiently large. Microfilm \$2.75; Xerox \$4.60. 86 pages.

EVAPORATIVE HEAT LOSSES OF DAIRY CATTLE AT HIGH ENVIRONMENTAL TEMPERATURES

(L. C. Card No. Mic 60-6830)

Robert Gilbert Yeck, Ph.D.

University of Missouri, 1960

Supervisor: Robert E. Stewart

The inability to adequately dissipate heat during hot weather is a major cause of productive losses among dairy cattle. The role of water evaporation from body surfaces as a means of heat dissipation was investigated. More specifically this included: (1) the determination of the rate of vapor loss from dairy cattle and calves at various environmental conditions; (2) the partitioning of this loss between skin and respiratory vaporization; (3) the correlation of vapor losses and animal heat production; and (4) the consideration of the confounding effects of breed, body weight, and milk production.

The vapor losses were measured in their entirety with a hygrometric tent. Respiratory vaporization and animal heat production were measured as a part of a concurrent investigation by others using an open circuit metabolism machine. The two test rooms of the Psychroenergetic Laboratory were used to house the test animals and provide the scheduled climatic conditions.

The investigation was in two parts, (1) the comparison of the vapor losses of 50° and 80° F acclimated calves when exposed to various temperature conditions and (2) the effects of humidity and temperature on vapor losses of lactating Holstein cows. For the calves, the effect of air temperatures within a 33° to 95° F range was studied with three animals of each of three breeds Jersey, Holstein, and Brown Swiss forming a temperature acclimated group, (one test room). For the cows, exposures were at 65°, 80°, and 90° F air temperatures with three levels of

humidity at 80° and 90°F. There were six Holstein cows in each of the two test rooms and three stages of lactation were represented, early, mid and late.

Evaporative heat loss, as determined through measurements of cattle vaporization rates, was found to be an important means of heat dissipation. It was evidently a reserve means of heat dissipation that cattle utilized as opportunities for convective and radiant heat dissipation were reduced because of increased ambient air and room surface temperatures. Results indicated that 65°F air temperature was a threshold condition at which vaporization rates began to sharply increase. The importance of evaporative heat dissipation was reflected in the finding that, with 45°F dew point temperature, evaporative heat dissipation of cows increased from 30 per cent of their total heat production at 65°F air temperature to 85 per cent of their total heat production at 90°F air temperature. The evaporative heat dissipation of calves increased from 15 per cent of their total heat production at about 33°F air temperature to 60 per cent and more of their total heat production at 95°F air temperature.

Increased humidity had a slightly depressing effect on total vaporization but practically no effect on skin vaporization. These results plus the presence of a sharp inflection point (at 65°F air temperature) in both total and skin vaporization versus air temperature curves indicated that cattle vaporization was more than a simple diffusion process.

The skin (outer body surfaces) was the major source of water vapor--accounting for from 60 to about 85 per cent of total vaporization among the calves and cows.

Age differences such as between the cows and calves and stage of lactation had no significant effect on total or skin vaporization.

With reference to vaporization rates, 50°F acclimated calves reacted differently than did 80°F acclimated calves when both were exposed to several other temperatures. However, the differences were not well defined and the question of the effect of acclimatization on vaporization remained without a definite answer.

Microfilm \$2.75; Xerox \$7.60. 163 pages.

ENGINEERING, CHEMICAL

CRYSTALLIZATION OF LEAD METANIOPATE FROM A GLASSY PHASE

(L. C. Card No. Mic 61-78)

Richard Charles Anderson, Ph.D.
University of Illinois, 1960

The objective of this investigation was to formulate a glass from which lead metaniopate, PbNb_2O_6 , could be crystallized, study its crystallization behavior, and measure the dielectric properties of these crystallized glass materials. Lead metaniopate has three known crystallographic forms. They are rhombohedral (stable up to 1150-75°C), tetragonal (stable from 1150-75°C to 1343°C), and the metastable orthorhombic form (exists only below 570°C). Orthorhombic PbNb_2O_6 is ferroelectric. It can

be formed by first preparing tetragonal PbNb_2O_6 , then cooling this crystal below 570°C where it transforms to the orthorhombic form.

A glass-forming composition was found containing 29.9% PbO , 35.7% Nb_2O_5 , 24.1% SiO_2 , and 10.3% Al_2O_3 . This composition was the only one investigated further. X-ray diffraction analysis indicated orthorhombic PbNb_2O_6 crystals were present in this glass after heat treatment above 1200°C.

A study of crystallization behavior was conducted with thin (2.5 microns) glass films formed by blowing bubbles from the melt at 1425°C. These films were fired at 28 temperature levels from 591° to 1250°C for three minutes. X-ray analysis indicated that rhombohedral PbNb_2O_6 crystals were formed as low as 667°C. Microscopic examination indicated that orthorhombic PbNb_2O_6 crystals were present in films fired from 1199° to 1229°C. No crystals were formed in films fired at higher temperatures.

The rhombohedral-tetragonal polymorphic transformation of PbNb_2O_6 was investigated by heating small, glassy chunks from 1175° to 1225°C for 10, 30, and 90 minutes. These samples were quenched in water after heat treatment and the percent rhombohedral and orthorhombic PbNb_2O_6 crystals determined by a quantitative x-ray diffraction technique. The assumption was made that any orthorhombic PbNb_2O_6 found was a transformation product of the tetragonal phase originally formed. The tetragonal phase was reluctant to form from the rhombohedral phase in the presence of the residual melt. The effect of time was not significant in promoting the development of the small amounts of tetragonal PbNb_2O_6 which were found between 1185° and 1205°C. The effect of temperature was primarily that of reducing the total crystal content from about 45% at 1175°C to 0% at 1217° to 1220°C. This latter temperature range was the liquidus temperature range of the composition.

Samples for electrical study were prepared by heating glass disks to between 1210° and 1250°C and cooling them between 5° and 70°C per minute. Polished sections of these samples were made and examined microscopically. Their dielectric constant and dissipation factors were measured from room temperature to 620°C, and the samples were quantitatively analyzed by x-ray diffraction. The type, amount, and geometry of crystals grown in the glass or melt was very sensitive to heat treatment conditions. At least one unidentified crystal form was detected under the microscope. Cooling the melt at 45°C per minute induced the largest amount of orthorhombic PbNb_2O_6 to form. These crystals formed as small, dendritically crossed needles embedded in a glassy medium. The dielectric constant of this sample ranged from 83.6 at room temperature to a maximum of 161.3 at 500°C. All samples containing orthorhombic PbNb_2O_6 , except one, exhibited maxima in dielectric constant and dissipation factor between 400° and 500°C when tested during heating. These maxima, which were thought to be due to a ferroelectric effect, disappeared when measurements were taken on the cooling samples. It was concluded that the loss of these maxima on cooling was the result of structural damage incurred in the sample during heating owing to thermal expansion and contraction effects. For eight samples fabricated and tested electrically, the $\% \Delta K$ per °C ranged from ± 0.006 to 0.042

up to 300°C. The dissipation factor remained below 1% up to between 175° and 375°C.
Microfilm \$2.75; Xerox \$5.00. 97 pages.

RELATIONSHIP OF CONDUCTIVITY
AND CATALYTIC ACTIVITY OF
SEMI-CONDUCTORS TO EXCITATION
BY GAMMA RADIATION

(L. C. Card No. Mic 60-6664)

Howard Arthur Davies, Ph.D.
The University of Florida, 1960

The investigation was concerned with the effect of gamma irradiation and temperature on the catalytic activity and electrical conductivity of semi-conductor zinc oxide.

The reaction chosen to evaluate the catalytic activity was the decomposition of methanol.

From the data obtained it was concluded that:

1. Internal irradiation via the doping of zinc oxide catalysts with Zn^{65} in the isotope concentration range of 0.0078 mc/gm to 0.54 mc/gm has no measurable effect on the catalytic activity of zinc oxide for the decomposition of methanol.

2. The electrical conductivity of zinc oxide increases with temperature and radiation intensity from an external Co^{60} source under the conditions of the present investigation.

3. The effect of gamma irradiation on the electrical conductivity is transient in nature and the magnitude of the increase in conductivity is independent of temperature in the temperature range 300-400°C.

4. The relative effects of gamma irradiation are greater at the lower temperature levels.

5. The effect of gamma irradiation is probably the elevation of electrons from donor levels, already existing in the zinc oxide, to the conduction band, or the creation of additional donor levels which are then ionized via thermal excitation.

6. The catalytic activity of zinc oxide for the decomposition of methanol may be increased via steady state external gamma irradiation in the temperature range 300-400°C with radiation intensities of 0.81×10^5 f/hr and 4.5×10^5 r/hr.

7. The increase in catalytic activity via gamma irradiation, like the increase in electrical conductivity, is transient in nature and the relative effects are greater at the lower temperature levels.

8. The catalytic activity of zinc oxide for the methanol decomposition is apparently related to its electrical conductivity.

9. Gamma irradiation apparently activates the zinc oxide catalyst in the same manner as thermal processes do and the relative magnitude of the electrical conductivity is a measure of the degree of activation.

Microfilm \$2.75; Xerox \$6.20. 128 pages.

DIGITAL COMPUTER SIMULATION
OF PULSE COLUMNS FOR
LIQUID-LIQUID EXTRACTION

(L. C. Card No. Mic 60-5533)

Bart A. DiLiddo, Ph.D.
Case Institute of Technology, 1960

The dynamic characteristics and controllability of pulse columns have been studied by simulation on an International Business Machines 650 Digital Computer.

A novel technique of numerically solving two sets of difference-differential material balance equations was employed. Generalized flooding and efficiency equations and control system equations were included in the mathematical model. Thus, the effects of design, operating, and extraction system variables on column dynamics and controllability may be studied.

Computer studies were conducted on 3-plate and 9-plate models. The extraction system (water-uranium-nitric acid-tributylphosphate) which is used in the Purex Process was used in this work. The effects of operating variables on equilibration time and the performance of control systems were studied. Many interesting response curves were obtained.

Microfilm \$2.75; Xerox \$5.60. 115 pages.

THE INITIAL RETENTION OF FIBERS
BY WIRE GRIDS

(L. C. Card No. Mic 61-409)

Ronald Bradford Estridge, Ph.D.
The Institute of Paper Chemistry,
affiliated with Lawrence College, 1961

Adviser: S. T. Han

The mechanism of retention of fibers by screens and wire cloth is of particular importance to the understanding of screening and sheet forming operations in the paper industry. This study was undertaken with the objective of increasing our fundamental knowledge of the retention process. Because of the complexity of the entire retention process, this work was limited to the initial retention of fibers by the bare grid in an idealized system. The specific objectives were to study the effects of fiber length and grid geometry on the initial rate of retention of rigid individual fibers by simple grids.

Because fibers have extreme axis ratios, the retention of a fiber by an aperture roughly corresponding in size to that of the fiber is a matter of chance. On this basis a general mathematical expression predicting the initial rate of retention was developed. This expression involves a probability function which is dependent upon the properties of the fiber, the structure of the grid, the hydrodynamic field, and the interactions between fibers. This expression was applied to the simple cases of the initial retention of rigid individual fibers by simple parallel and square mesh grids.

An apparatus was designed and constructed for the purpose of conducting experiments to verify the predicted relationships. Stiff nylon fibers cut to narrow fiber length

ranges and grids constructed of fine wires were used to simulate the conditions of the mathematical model. The initial retention rates measured experimentally agreed very well with the predicted values. Under the experimental conditions, flow rate and fiber concentration had only very minor effects on retention. This agreement is accepted as strong evidence in favor of the validity of the probability basis of predicting initial retention and the general approach to the problem of fiber retention used in this study.

By comparing results for the two geometries studied, some general conclusions can be made concerning the most efficient use of wire grids for the screening and filtration of fiber suspensions. For classifying mixtures of fibers according to length, the square mesh geometry was found to be most efficient. For obtaining the greatest retention of fibers during filtration of a fiber suspension, the choice of the most efficient geometry depends upon the relative length of the fibers. For relatively short fibers the parallel mesh is more efficient, while for long fibers the square mesh is more efficient.

The area in which the analysis of initial retention will probably be of most immediate value is that of screening and classification of fiber suspensions. In these operations no deposit is allowed to form on the screen and the initial retention relationships will apply at all times. Although this work was limited to an idealized system, it is suggested that the results would apply to more complex systems as indicated by the agreement of literature data for Bauer-McNett screens with the theory. It is also expected that the method of analysis used here can be further developed to account for more variables and will be of use in predicting retention in more complicated systems. Microfilm \$2.75; Xerox \$6.40. 134 pages.

MASS TRANSFER IN LIQUID METALS AND OTHER MEDIA

(L. C. Card No. Mic 61-509)

William Nelson Gill, Ph.D.
Syracuse University, 1960

The mechanism for mass transport is examined for deposition and solution effects along Type 304 stainless steel flat plates in a closed loop lithium system. It is found that the rate determining process for solution is solid phase diffusion whereas deposition rates are liquid phase controlled. This in large measure explains the plugging behavior observed in non-isothermal heat transfer systems since deposition rates are orders of magnitude larger than solution rates for a given concentration driving force.

Von Karman's analysis of the turbulent boundary layer along a flat plate, combined with the Chilton-Colburn empirical modification of the Schmidt group, predicts liquid phase mass transfer coefficients for deposition rates with reasonable accuracy. However, the Nusselt numbers obtained from this procedure appear to be slightly low and the agreement would be improved by a Schmidt group modification similar to that obtained in the analytical calculations described in Section VI.

The total mass flux along a flat plate is substantially

linear in $(\frac{V\rho L}{\mu})^{0.8}$ for liquid-phase controlled processes over the range investigated. When solid-phase diffusion controls, the total mass flux is essentially independent of fluid velocity and directly proportional to the plate length. This behavior provides a convenient means for determining the mass transport mechanism in liquid metals or other media.

Perhaps the single most important variable in liquid alkali metal corrosion or mass transfer investigations is the contamination level. Variable or excessive contamination, particularly oxides and nitrides when dealing with lithium, cause erratic and misleading experimental results. This difficulty was satisfactorily controlled by continuous filtration which maintained contamination at a very low level.

Also, a generalized heat and mass transfer calculation is reported which accounts for the exact variation in momentum, heat and mass flux across the boundary layer for fully developed parallel flow. The eddy diffusivity functions employed were calculated from the concentration distribution data of Lin, Moulton and Putnam (31). This analysis compares favorably with existing experimental heat and mass transfer data over a wide range of

Reynold's $(\frac{d\rho V}{\mu})$ and Schmidt $(\frac{\mu}{\rho D_L})$ numbers, and

further illustrates the desirability of investigating turbulence near solid boundaries by means of heat and mass transfer measurements rather than by velocity distribution studies.

Calculations for flow between infinite parallel plates

and in smooth circular tubes indicate that Nusselt $(\frac{hd}{D_L})$

numbers based on bulk mean quantities differ for these configurations. Since mean quantities, for identical distributions, differ in the two configurations this result is not surprising. In addition, the heat or mass flux distributions in the radial direction deviate more from linearity for circular tubes. For both circular tubes and infinite parallel plates the deviations from the linear momentum flux distribution are most pronounced at low Prandtl

$(\frac{C_p \mu}{k})$ or Peclet $(\frac{d\rho V C_p}{k})$ numbers.

Microfilm \$2.75; Xerox \$7.00. 146 pages.

THERMODYNAMIC PROPERTIES OF SULFUR DIOXIDE

(L. C. Card No. Mic 60-6626)

Tzu-Liang Kang, Ph.D.
The University of Texas, 1960

Supervisor: Dr. John J. McKetta

Sulfur dioxide is one of the important refrigerants in use. The thermodynamic properties have never been evaluated in the high pressure range. The present investigation was undertaken to evaluate these properties from the P-V-T data of sulfur dioxide.

In this work, the pressure-volume-temperature data of ultra-pure sulfur dioxide were measured by means of a Beattie-type apparatus. The range covered was 5 to 312 atm. and from 50 to 250°C. at intervals of 25°C. The vapor pressures and the orthobaric densities were measured and correlated. The critical constants were determined. The latent heats of vaporization, calculated by the Clayperon equation, were correlated. The compressibility factors were smoothed by means of the graphical residual method. The fugacity coefficients, from 10 to 250°C., were numerically integrated from the volume residuals.

In conjunction with other data in literature, the above results were used in the evaluation of the thermodynamic properties of sulfur dioxide from -100 to 480°F. for pressures up to 4500 psia. Numerical methods were employed. An IBM 650 digital computer was used to carry out the calculation.

A Mollier diagram was constructed to present the enthalpy and entropy values of superheated gaseous sulfur dioxide, the properties of saturated sulfur dioxide and the quality lines.

A Benedict-Webb-Rubin type equation of state was fitted to the experimental P-V-T data. The ability of this equation to represent the volumetric behavior of sulfur dioxide was studied. Thermodynamic properties were calculated from this equation of state. The agreement of the results from both methods was very good.

Microfilm \$4.85; Xerox \$17.10. 377 pages.

ANALYTICAL REPRESENTATION OF MULTI-COMPONENT EUTECTIC SYSTEMS

(L. C. Card No. Mic 60-5545)

Imrich Klein, Ph.D.

Case Institute of Technology, 1960

A method is developed and presented for predicting, from binary data, the polythermal surfaces in ternary phase diagrams by a technique of fitting second or third order analytical equations to the surfaces. The calculations involved in obtaining coefficients for the surface equations, as well as for the equations needed for determining the Jänecke projections and isothermals in ternary systems, have been formulated as programs for the IBM 650 digital computer.

The method has been applied in calculating ternary phase diagrams for known systems of fused salts, organic compounds and metals. Results have compared favorably with the published ternary data for the systems.

The analytical representation by means of Second order equations has also been applied to systems where ternary data are available; in these cases the equations of the surfaces are useful for interpolation and extrapolation, and for computation of isothermals and the Jänecke projection. Microfilm \$2.75; Xerox \$4.80. 95 pages.

AN EXPERIMENTALLY VERIFIED THEORETICAL ANALYSIS OF THE FALLING CYLINDER VISCOMETER

(L. C. Card No. Mic 61-282)

John Lohrenz, Ph.D.

University of Kansas, 1960

A theoretical analysis was made for laminar fluid flow in the annulus of the falling cylinder viscometer. Encouraging agreement between previous experimental results and the analysis led to the design of a new viscometer body which fits the theoretical model more closely.

The new viscometer body was equipped with stabilizers removed from the cylindrical section of the body. The frictional effect of the stabilizers was negligible. Experimental results with a series of bodies of this type were obtained through a temperature range of -100 to 100°C. and pressures as high as 600 lb./sq. in. Viscosities ranged from 3 to 0.01 centipoise. Resulting terminal velocities were from 30 to 0.01 cm./sec.

Experimental results showed improved agreement with the theoretical model. Effects of temperature and pressure were accurately predicted by this theoretical model. The experimental data were correlated within $\pm 0.6\%$ on a viscometer calibration plot developed from the theoretical model. This precision was better than obtained with the previous type of calibration plot.

The entrance-exit frictional effect was evaluated from the experimental data and correlated on a friction factor plot. Fluid flow in the annulus remained laminar up to a Reynolds number of at least 10. Using the exit-entrance friction factor plot and the theoretical model, falling cylinder viscometers can be designed and operated without calibration within an accuracy of 3%.

Microfilm \$3.20; Xerox \$11.05. 245 pages.

THE THERMODYNAMIC PROPERTIES OF NORMAL PROPYL ALCOHOL

(L. C. Card No. Mic 60-6629)

Joseph Franklin Mathews Jr., Ph.D.

The University of Texas, 1960

Supervisor: Dr. John J. McKetta

The Chemical Engineering Department at The University of Texas is currently engaged in the determination of the properties of selected industrially important oxygenated hydrocarbons. As a part of this program, the vapor heat capacities of normal propyl alcohol were measured in a temperature range of 371.2 to 451.2°K. and a pressure range of one-third to five-thirds atmospheres, absolute. Latent heats of vaporization were measured in a temperature range of 343.9 to 384.5°K. A model of an equilibrium formation of dimers and tetramers was used to represent the behavior of vapor heat capacity as a function of pressure, and ideal vapor heat capacities were determined.

The experimental ideal vapor heat capacities were used, along with literature data on molecular structure

and spectra, to evaluate the barriers to internal rotation in the normal propyl alcohol molecule. Thermodynamic properties of this compound were computed at selected temperatures from 0 to 1000°K.

Microfilm \$2.75; Xerox \$3.00. 57 pages.

TEMPERATURE AND CONCENTRATION GRADIENTS WITHIN POROUS CATALYSTS

(L. C. Card No. Mic 60-6565)

John Orville Mingle, Ph.D.
Northwestern University, 1960

Supervisor: Dr. J. M. Smith

An investigation of temperature and concentration gradients within porous catalysts has lead to the effect of pore size distribution and temperature on effectiveness factors. A model for a porous catalyst material is proposed whereby a catalyst pellet is composed of catalyst granules compressed together forming a macroscopic void volume between the granules. In this macro volume, containing a very small fraction of the total internal pellet surface area, bulk diffusion of reactants and products will occur. Within the catalyst granules a microscopic pore size distribution is present, and Knudsen diffusion will be predominant. A surface chemical reaction following an Arrhenius type temperature dependence will also be occurring.

Graphs and Tables have been prepared to allow a rapid comparison of low temperature nitrogen adsorption data so as to ascertain an approximate, analytical, micro-pore size distribution. Two general types are used, Maxwellian or Gaussian. The constants obtained by the application of the BET equation are needed in this comparison.

Numerical results for the microeffectiveness factor show that no more than a ten percent deviation is caused by micro pore size distribution effects. A distribution characterized by only a single size of pore gave the largest effectiveness factors. Temperature dependent calculations for the micro case show that for an exothermic, first order, irreversible reaction the effectiveness factor is increased over the linear, temperature independent, case. This increase is quite large for certain combinations of parameters, i.e., a high heat of reaction, a moderate to high activation energy, and a slow reaction rate. Micro effectiveness factors as high as twelve have been calculated. Since the physical size of the catalyst granules is quite small, it is expected that temperature effects would normally be small and within the range of a straight line function of temperature parameters when the deviation between the linear and nonlinear cases is considered.

For the macro effectiveness factor a homogeneous pellet is assumed with the reaction rate at any point governed by the micro effectiveness factor having pore mouth conditions of the actual point values of concentration and temperature. This assumption makes the macro dependence upon pore size distribution similar to the micro case. Temperature effects in the macro case are generally accentuated over the micro case since the particle is many times larger. With the larger temperature gradients the effectiveness factor for an exothermic reac-

tion may be quite high. For the cases investigated numerically the parameter values were not sufficient to show an unusual deviation.

For exothermic reactions temperature effects tend to compensate somewhat for diffusional and pore size distribution effects.

Microfilm \$2.75; Xerox \$6.20. 126 pages.

FLOW PATTERNS AND MIXING RATES IN AGITATED VESSELS

(L. C. Card No. Mic 60-5366)

Kenneth Westcott Norwood, Ph.D.
University of Delaware, 1960

Supervisor: A. B. Metzner

Very little data on mixing rates and flow patterns in agitated vessels have been reported in the literature. Furthermore, few attempts have been made to explain the mixing process in the light of these data.

The present study has been concerned with the determination of the flow factors which control mixing rates and the development of a mixing model based on these factors.

Flat-blade, dimensionally-similar turbines with diameters 2, 4 and 6 inches were used. Tank diameters ranged from 5.76 to 15.5 inches. The baffle width equaled one-tenth of the tank diameter in all runs. Flow rate and mixing rate data were obtained over the Reynolds number ranges of 36 to 1.72×10^4 and 3 to 1.8×10^5 , respectively.

A mixing model based on the assumption that nearly all of the mixing occurs in a "perfectly-mixed" volume V near the impeller was shown to be applicable for the Reynolds number range of 36 to 1.72×10^4 . Equations relating the volumetric flow rate and mixing time to the operating variables were developed for Newtonian fluids. In addition, predictions were made concerning mixing rates in non-Newtonian fluids.

Studies of the intensity of turbulence and streamline flow paths throughout the tank must be made to explain processes which are not covered by the mixing model. Quantitative studies of the agitation of non-Newtonian fluids are also needed.

Microfilm \$2.75; Xerox \$7.60. 165 pages.

SOLIDS-GAS CONTACTING IN FLUIDIZED BEDS

(L. C. Card No. Mic 60-5369)

John Chandler Orcutt, Ph.D.
University of Delaware, 1960

Supervisor: R. L. Pigford

Fluidized beds may be characterized by both a distribution of "contact times" and by theoretical models which take into account both mixing within the bed and mass transfer between regions of high and low solids concentration within the bed. The distributions may be related to

the models by taking advantage of the fact that an exact functional relationship exists between the moment generating function of the distribution and the fraction remaining of a reactant being converted by a first-order heterogeneous reaction.

To find the distribution of contact times and to test models for fluid bed behavior, the ozone decomposition reaction on an iron oxide-impregnated silica-alumina cracking catalyst was carried out in 6 and 4-inch diameter reactors with gas velocities up to 0.5 ft./sec.

The measurements showed that a finite amount of by-passing took place which was independent of system variables. The variances of the observed contact time distributions were in agreement with variances estimated from two simple theoretical models, thus affirming the general accuracy of the models. A third, more complex model was also tested by computing its parameters from the data by a least-squares procedure, and was found to be slightly superior to the simpler ones.

The usefulness of mathematical models for computing the performance of fluid bed equipment as catalytic reactors is therefore supported by this work.

Microfilm \$2.75; Xerox \$8.00. 173 pages.

THE CATALYZED REACTION OF OXYGEN WITH SULFUROUS ACID AND ITS EFFECT ON THE ABSORPTION OF OXYGEN AND SULFUR DIOXIDE INTO WATER

(L. C. Card No. Mic 60-5371)

Philip Walter Pritchett, Ph.D.
University of Delaware, 1960

Supervisor: R. L. Pigford

The absorption of sulfur dioxide and oxygen into a manganese sulfate solution was investigated to observe the influence of the liquid phase oxidation reaction on the rates of absorption. This particular system is of potential importance in controlling air pollution. The homogeneous chemical reaction follows a complex kinetic expression. The theoretical analysis in this research is directed toward a general understanding of absorption with simultaneous irreversible reaction and the development of procedures for predicting absorption rates in other cases of complex reaction.

The investigation was carried out in two phases: a study of the kinetics of the liquid phase reaction and a study of the absorption with simultaneous reaction. A solution of dissolved oxygen was mixed with a solution of sulfur dioxide containing manganese sulfate catalyst in a continuous flow reactor. The completion of reaction was measured by the rise in temperature using a thermistor detector. A temperature compensated Wheatstone bridge circuit sensitive to 0.0003° C. was developed for measuring the small temperature changes. The reaction followed an accelerating kinetic expression. A plausible mechanism was developed, and the data were fitted to the rate expression derived from the mechanism:

$$\text{rate} = a \sqrt{\text{oxygen concentration}} e^{b(\text{time})}$$

The rate of absorption was studied by absorbing oxygen and sulfur dioxide into a manganese sulfate solution in a short wetted-wall column. The traces of sulfuric acid formed by the reaction were measured by a conductivity method which was sensitive to 10^{-5} M sulfuric acid in the presence of 0.1 M manganese sulfate. The absorption rates were interpreted in terms of the kinetic rate expression and the penetration theory of absorption. The theory was developed by first examining the characteristics of absorption with simultaneous irreversible reaction and then considering the special problem of absorption with an accelerating reaction. Absorption rates predicted from theory agreed with the observed rates.

When the oxygen concentration was reduced, the occurrence of reaction increased the absorption rate at a shorter contact time. This absorption experiment revealed the role of oxygen in the kinetics more clearly than was possible from the study of liquid phase kinetics alone. The concentration of active catalyst increased by an accelerating process which was independent of the oxygen concentration; and sulfuric acid was formed at a rate proportional to the concentration of active catalyst and to the square root of the oxygen concentration.

New theoretical developments include an exact analytic solution for absorption rates with simultaneous zero order reaction and a general approximation method based on the steady-state solution for absorption rates with simultaneous reaction.

Microfilm \$3.35; Xerox \$11.70. 257 pages.

THE CATALYTIC EFFECT OF IRON ON THE CARBON-CARBON DIOXIDE REACTION

(L. C. Card No. Mic 61-61)

John Francis Rakaszawski, Ph.D.
The Pennsylvania State University, 1960

The effect of iron, as a catalyst, on the carbon-carbon dioxide reaction was investigated. Iron was added to spectroscopically pure graphite powder either by mixing iron powder with the graphite in the dry state or by impregnating the graphite with a solution of ferric oxalate. The iron powders used varied in particle size from 20 microns to 150 x 450 A. After the addition of iron, the graphite was molded in rod-form at 100,000 psi. and room temperature. Some of the rods were reacted with carbon dioxide without any prior heat treatment, whereas others were heat treated to temperatures of 1600°C. and higher prior to reaction at lower temperatures. The rate of the carbon-carbon dioxide reaction was measured over the temperature range 900° to 1200°C. In addition to heat treatment temperature and reaction temperature, other variables studied were particle size of iron and concentration of iron.

Under certain conditions, iron was a very effective catalyst for the carbon-carbon dioxide reaction. For example, the presence of as little as 0.05 weight per cent iron caused the rate of reaction to increase by a factor of 170 at a reaction temperature of 1000°C.

The reactivity of graphite doped with iron generally increased as the particle size of iron decreased. This

especially was evident at a reaction temperature of 1000°C.

As the iron concentration increased, the reactivity increased up to about 0.5 weight per cent iron. The increase in reactivity was not directly proportional to iron concentrations.

Heat treatment of the iron doped samples to 1600°C., prior to reaction, decreased the catalytic activity of the iron. The activity of the catalyst could be regenerated by pretreating the samples with hydrogen at 1000°C. or oxygen at 450°C. In many cases, the catalyst was activated during the initial stages of the reaction rate determination. These results were in line with the postulate that the decrease in catalytic activity was due to the presence of carbon within the particles of iron.

When samples containing iron were heat treated to temperatures between 1600°C. and 2990°C. prior to reaction, a sharp decrease in reactivity was found over the heat treatment range 1600° to 2250°C. Higher heat treatment temperatures had little additional effect on reactivity.

In many cases, activation energies of zero were obtained with samples that had been heat treated to 1600°C. before reacting with carbon dioxide. This was especially true at reaction temperatures of 1050° and 1100°C.

Microfilm \$2.75; Xerox \$6.40. 133 pages.

AN EXPERIMENTAL STUDY OF LIQUID-PHASE TURBULENT DIFFUSION

(L. C. Card No. Mic 61-264)

Robert Edward Sparks, D.Eng.
The Johns Hopkins University, 1960

Major Professor: Dr. H. E. Hoelscher

An investigation was made of turbulent mass transfer in the fully developed turbulent wake of a circular cylinder. The study was conducted in the liquid phase, in the controlled flow field of a water tunnel, analogous to an aerodynamic wind tunnel. A series of screens was used to control the velocity and turbulence fields in the working section.

The intensity of turbulence in the water tunnel was measured, using a modification of the method of Schubauer(1), previously applied only in air.

The decay of turbulence intensity downstream from screens was measured and found to approximate closely the decay measured in air by Schubauer. The decay also follows the -5/7 power law of Frenkiel(2). The decay far downstream from the screens was found to be determined not by the screens, but by the comparatively thick turning-vanes located upstream from the screens. This phenomenon was predicted by Taylor(3) and experimentally verified in air by Schubauer, Spangenberg, and Klebanoff(4).

In order to set up a concentration field having strong gradients, a hollow aluminum cylinder having a porous wall was placed transverse to the direction of bulk flow and a solution of potassium nitrate fed at a constant rate to the inside of the cylinder. Since the cylinder Reynolds Numbers were above 1000 for all cylinders, the wakes were turbulent.

Concentration profiles in the electrolyte wake were

measured with an electrical conductivity probe. The fluctuations were of such scale and frequency that a signal-averaging technique had to be developed to allow averaging over time periods of the order of minutes. This was accomplished by placing the conductivity cell in series with a composition resistor, and imposing on this series circuit a constant AC voltage, supplied by a 0.01% AC regulator. As the concentration between the cell electrodes changed, the current in the circuit changed, heating the resistor accordingly. Several coils of wire having a high temperature coefficient were wound around the resistor and connected as one leg of a sensitive recording DC bridge. The pen position was calibrated in terms of concentration. To add thermal mass to the system the wound resistor was encased in plastic. In this manner the fluctuations of the system were sufficiently damped.

The effect of turbulence on the diffusion process was described by applying the Reynolds restrictions to the diffusion equation and then using the boundary layer approximations. A transport coefficient was written as a flux divided by a negative gradient,

$$\epsilon = \frac{-\int_0^y \bar{U} \left(\frac{\partial \bar{C}}{\partial x} \right) dy}{-\left(\frac{\partial \bar{C}}{\partial y} \right)}$$

Where ϵ = transport coefficient

x = direction of bulk flow

y = direction perpendicular to x and the cylinder axis

\bar{U} = velocity in the x -direction

C = concentration

overbar = time average

Reduction of the concentration, velocity and turbulence intensity data taken in the cylinder wake gave the correlation

$$\epsilon = 0.082 U_0 b \left(\frac{\nu'}{U_0} \right)$$

Where U_0 = velocity in the x -direction, outside the wake

ν' = RMS fluctuating velocity in the y -direction

b = width of the shear region.

The possible error of this correlation is estimated to be 40%. The correlation was compared with literature data for heat transfer in mercury, mass and heat transfer in air, and mass transfer in water.

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- (2) Frenkiel, F. N., Trans. ASME, 70, 311 (1948).
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- (4) Schubauer, G. B., Spangenberg, W. G., and Klebanoff, P. S., NACA Tech. Note No. 2001 (1950).

Microfilm \$2.75; Xerox \$9.45. 207 pages.

ENGINEERING, CIVIL

COMBINED LOCAL AND OVER-ALL BUCKLING
OF RECTANGULAR THIN-WALLED
TUBULAR COLUMNS

(L. C. Card No. Mic 61-105)

Jacques Cohen, Ph.D.
University of Illinois, 1960

The Rayleigh-Ritz procedure has been applied to the study of the combined action, within the elastic range, of local (plate) and over-all (column) buckling of rectangular thin-walled tubular columns. The dimensions of the column are arbitrary, provided that the plates parallel to the direction of over-all buckling do not buckle; plate buckling occurs only in the flange plates which are those perpendicular to the direction of over-all buckling. The flange plates are assumed to be hinged along the longitudinal edges of the column and to buckle in a square pattern.

The selection of the analytical expression for the assumed deflected shape has been based on existing solutions for column and plate action considered individually. The limitations of the small deflection theory of columns and large deflection theory of plates, assuming that Poisson's ratio is equal to zero, apply equally well to the analysis of the combined action. The investigation is restricted to the early post-buckling range of the flange plates for which the assumed deflected shape is known to yield significant results and no change in the buckle pattern is expected to occur. Small initial eccentricities have been introduced in both column and component plates thus reducing the buckling problem (eigenvalue) to a stress analysis. The introduction of the initial eccentricities also allows the study of their effect on the behavior of actual columns.

The minimization of the total energy of the column leads to a system of nonlinear algebraic simultaneous equations. A computer program, based on Newton's method, has been prepared for the solution of the system of the non-linear equations. The initial eccentricities and the geometry of the column constitute the data utilized by the computer in the numerical solution of the equations. The results are presented in diagrams expressing the variation of the important generalized coordinates with the applied load.

It has been found that when the critical stress of the flange plates approximates the Euler stress for the column, and when the moment of inertia of the flanges represents a considerable part of the total moment of inertia of the cross section, there is little reserve of strength in the column after plate buckling has occurred. The approximate bounds within which the preceding statement applies have also been estimated. The results also indicate that large initial eccentricities in both plate and column lessen the effect of combined action. The same conclusions may be applied to the case of a panel formed by juxtaposition of rectangular tubes.

Proposals for improving and extending the analysis to include more general cases are outlined at the end of the study. Microfilm \$2.75; Xerox \$3.60. 61 pages.

ACCUMULATION OF MOISTURE IN SOIL
UNDER AN IMPERVIOUS SURFACE

(L. C. Card No. Mic 61-457)

Jack LeRoy Mickle, Ph.D.
Iowa State University of Science and Technology, 1960

Supervisor: Merlin Grant Spangler

The objective of this study was to compare the long time accumulation of moisture in a soil subgrade beneath an impervious surface with the estimated equilibrium moisture content based upon measurements of the moisture retention characteristics of the soil and the elevation of the ground water. Moisture accumulation due to the formation of ice was not considered.

A theoretical approach, based on thermodynamics, was used to evaluate the free energy per unit mass of water in a soil water system in terms of component free energies. Thus the effects of adsorptive and gravitational force fields, surface tension, pressure and dissolved materials were considered. By assuming that the osmotic and adsorptive force field effects were small, the thermodynamic argument reduced to the capillary potential concept.

The experimental investigation outlined in this dissertation was conducted in two phases. The first phase involved the routine tasks of periodically determining soil moisture contents, soil temperatures and water table elevations under an impervious surface constructed of alternate layers of asphalt roofing paper and asphalt cement. The second phase was conducted to determine the soil-moisture retention characteristics, in the form of desorption curves, and other properties of a series of undisturbed soil samples taken from under, and adjacent to, the impervious surface near the close of the field investigation, or first phase.

The findings of the investigation are summarized:

1. The terminal equilibrium moisture contents in a soil column under an impervious surface can be predicted from desorption curves run on undisturbed samples of the soils providing water table and temperature data are available. Soil stratification does not affect the predicted values.
2. Temperature has only a minor effect on the terminal moisture contents thus predicted except where extreme temperatures are encountered. Actual changes in moisture content resulting from temperature changes can be estimated within close limits using a proposed approximate method.
3. Two samples of a given soil at different densities will have different equilibrium moisture contents at a given moisture tension; the less dense sample having a higher moisture content. Therefore under normal field conditions where increasing soil density is noted with increasing depth, it is possible to note increasing moisture contents with increasing height above the water table, thereby giving the false impression that some mechanism is at work which causes saturation of the soil beneath an impervious surface.

Microfilm \$3.15; Xerox \$11.05. 242 pages.

INFLUENCE OF SOME IOWA AGGREGATES ON THE DURABILITY OF ASPHALTIC CONCRETE MIXES

(L. C. Card No. Mic 61-468)

The Ngoc Phan, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Ladis H. Csanyi

Considering the fact that from ninety-three to ninety-six percent of an asphaltic concrete mix consist of mineral aggregates, their influence on the durability of the mixture has received relatively little attention.

In this investigation, carbonate rocks from three quarries located in Central and Southwest Iowa were studied in conjunction with the performance of four sections of asphaltic concrete pavements, in which they were used as coarse aggregates.

Qualitative X-ray diffraction analyses revealed that dolomitic rocks from one quarry were used on two paving projects and calcitic rocks from the other two quarries were used in the remaining two projects. These results were corroborated by chemical analyses using ethylenediaminetetraacetic acid (EDTA).

The following characteristics of the rocks were studied:

- 1) Porosity and pore-size distribution by means of a mercury porosimeter.
 - 2) Absorption of water, kerosene and asphalt cement by the aggregates. The penetration of asphalt into the rocks was measured from the cut sections of field cores taken after two and three years under traffic.
 - 3) Adhesion of asphalt to the rocks as measured by the unconfined compressive strengths of 4" x 4" specimens before and after soaking for four days in water at 120°F.
- The dolomitic rocks were found to be more porous than the calcitic rocks and to absorb relatively more asphalt. The rate of hardening of the asphalt cements seemed to vary in direct proportion with the porosity and absorptivity of the rocks.

No correlation could be established between the mineral composition of the stones and their affinity with asphalt. Apparently, as far as adhesion is concerned, the amount and nature of the insoluble residues in hydrochloric acid together with the shape and texture of the rocks, are more important than the relative proportions of calcite and dolomite. Microfilm \$2.75; Xerox \$6.00. 125 pages.

ENGINEERING, ELECTRICAL FAILURE STATISTICS OF ELECTRONIC NETWORKS

(L. C. Card No. Mic 60-6222)

Blair E. Bona, Ph.D.

University of Utah, 1960

Chairman: L. Dale Harris

Multivariate regression analysis is presented as a method of predicting the performance of electronic cir-

cuits. Briefly, approximate functions which adequately represent the relationships between any number of performance parameters and any number of circuit variables are obtained empirically. From these approximate functions, the means, variances, and covariances of the performance parameters are estimated. These statistics are obtained as functions of time and environment; accordingly, the probability of a circuit meeting a set of given specifications is estimated as a function of time and environment.

Invaluable design information is obtained from the analysis in that the statistics of the performance parameters are functions of the statistics (mean and variances) of the circuit variables. Thus, it is possible to control the statistics of the performance parameters by controlling the statistics of the circuit variables. From the analysis, it is also possible to ascertain the amount each of the circuit variables influences the performance parameters. In this sense, critical circuit variables are isolated and their effect on the performance parameters easily assessed. This makes it possible to intelligently specify tolerances throughout the circuit.

Two examples are presented to illustrate the application of the regression technique. In the first example, only one performance parameter is considered; in the second example, two performance characteristics are treated. The probability that the performance parameters will meet (simultaneously) a set of arbitrary requirements is estimated. Microfilm \$2.75; Xerox \$4.80. 92 pages.

TRANSFER FUNCTION SYNTHESIS BASED ON CASCADED RC AND RL NETWORKS

(L. C. Card No. Mic 61-95)

Donald Albert Calahan, Ph.D.
University of Illinois, 1960

A method of partitioning transfer functions into RC and RL subnetwork functions is developed. It is shown that the poles of any transfer function realizable by cascaded RC and RL subnetworks are restricted by the condition

$$\sum \arg s_i \leq \frac{\pi}{2}$$

where the $-s_i$ are the upper half plane complex poles. Sufficient conditions are derived for the realization of any transfer function in the RC-RL form. A procedure is also developed for maximization of the gain constant of certain classes of transfer functions when realized by this model.

An active network structure, first proposed by Horowitz and consisting of RC networks cascaded with an inverter (gyrator), is shown to have transfer functions similar to the RC-RL passive model when both are written in terms of subnetwork functions. The realizability conditions derived for the latter are applied to the active model. In addition, the sensitivity of the transfer function poles to changes in the inverter is studied. A partitioning procedure is developed which simultaneously minimizes sensitivity at all poles. It is shown that this minimum pole sensitivity to the active element is always less than that obtainable by other active models involving partitioning

into positive and negative RC subnetwork functions. Examples are given to illustrate the theory.

Microfilm \$2.75; Xerox \$6.20. 129 pages.

ANALYSIS OF POWER SYSTEM'S POWER-DENSITY SPECTRA

(L. C. Card No. Mic 60-6541)

James Louis Cooke, Ph.D.
Northwestern University, 1960

The over-all objective is the determination of the power-density spectra of a power system whose load is represented as a gaussian, stationary random process. The influence of system parameters such as inertia, governor droop and dead band, and a transmission link with another system is ascertained, based on the assumptions that the power system load has a white noise type of power-density spectra, and the maximum amplitude of the power system's voltage remains constant.

The solution for the power system's spectra is carried out analytically using techniques employed in frequency modulation processes. The influence of the power system parameters is determined by an approximate numerical solution of the analytical expressions on a digital computer. The investigation of governor dead band as dead zone is achieved analytically through the use of a known quasi-linearization method. The study of governor dead band as friction-loaded backlash is effected through the digital computer simulation of backlash alone, and with the other power system components, using standard normal deviates as the input.

The power system's spectra is found to be symmetrical about the center frequency (60 cycles per second), and to have the greatest concentration at this frequency. Secondary spectra peaks are sometimes found to occur at multiples of the damped natural frequency of the power system away from the center frequency. The presence or absence of these secondary peaks is found to be related to the power system properties, principally damping ratio and mean square value of the load. Transmission links between two systems complicate the spectra, but the beneficial effect of ties between comparable systems is placed in evidence as is a possible disadvantage to a system connected to one ten times its size. The influence of isochronous regulation in discretely concentrating a large amount of the spectra at the center frequency is illustrated. The superiority of examining the spectra instead of mean square deviations is particularly emphasized by this last example.

Applying the characteristic function approach to dead zone leads to a theorem relating the proportionality factors between the crosscorrelation function across an instantaneous nonlinear device and the components of its input autocorrelation function, to the gain values that minimize the mean square error in a quasi-linear analysis of the device, under certain conditions. Simulation of backlash results in the solution for the linear weighting function that minimizes the mean square error in using it in a quasi-linear analysis. A fairly good approximation for this weighting function is found to be the product of a gain and exponential function which are dependent upon the

autocorrelation function of the input to the backlash as well as the backlash width. The validity of this representation is shown by comparison with the results of the power system simulation. These results establish the major effect of governor dead band in an individual power system as increasing the apparent droop of the governor.

Microfilm \$2.75; Xerox \$8.00. 173 pages.

AN AUTOMATIC RECORDER FOR THE UTAH X-RAY STRUCTURE COMPUTER

(L. C. Card No. Mic 60-6226)

Philip James Elsey, Ph.D.
University of Utah, 1960

Chairman: Dr. S. B. Hammond

The Utah Computer was built at the University of Utah in 1948-52. In it, use was made of autosyn units to accomplish mechanically and electrically the summation expressed by the equation:

$$\rho(xy) = \sum_h \sum_k F_{hko} \cos 2\pi(hx + ky).$$

Data for the computer was obtained from the film of a Weissenberg camera on an x-ray diffraction instrument. For this purpose the computer was provided with a means to accept the input data in the form of values of h and k from 0 to 8 both plus and minus; the values of F were taken from the square-root of the film spot density and were given the values of 0, 1, 2, ..., 12. The values of x and y are the coordinates of a point on a two-dimensional plot of electron density. Previously the output from the computer was plotted manually with x as the abscissa and y as the ordinate with each divided into 60 parts. In other words, a two-dimensional picture was plotted on a 60 by 60 grid or 3600 points had to be plotted.

It was to avoid the necessity of this manual work that the automatic recorder was built. Under the proper conditions data taken from a photographic film of an x-ray diffraction instrument may be fed into the Utah Computer and the two-dimensional crystal structure is automatically plotted on an 18 inch by 18 inch chart with the abscissa divided into 60 parts but with the ordinate continuous. Two such charts made about different crystal axes provide enough information to classify the crystal and to compute the points of maximum electron density within it. The maximum density points indicate the position of atoms in the crystal cell.

Microfilm \$2.75; Xerox \$3.60. 62 pages.

ANALYSIS OF AN OSCILLATING CONTROL SYSTEM

(L. C. Card No. Mic 61-417)

Richard Emmerich Gorozdos, Ph.D.
University of Maryland, 1960

Supervisor: Dr. T. C. Gordon Wagner

In linear control systems employing feedback, variations in gain in the forward loop are usually accompanied by a degradation in performance. If these gain variations are too severe, the system may become unstable. This research considers placing a high gain amplifier with a limited output in the forward loop, thus causing the system to operate in a nonlinear limit cycle state. The only nonlinear portion of the system is the high gain, limited amplifier. The effective linear gain, or describing function, of this nonlinearity is inversely proportional to the gain of the linear portion of the system. Thus the over-all system is not influenced by variations in linear gain.

The describing function of the nonlinearity is considered in detail. It is shown to be a monotonic function of the amplitude of the input signal and a discontinuous but bounded function of the frequency of the input signal. The describing function is expressed as a power series in k where k is the ratio of the amplitude of the input signal to the amplitude of the signal returned to the summation point by way of the feedback path. One power series is obtained if the ratio of the input frequency to the frequency of the limit cycle is an irrational number. This series is not a function of this irrational number. Another power series is obtained if this ratio is a rational number. This series is a function of the rational number. The series obtained from the rational ratio approaches that of the irrational ratio as this ratio approaches zero. There is also some phase shift associated with the describing function if the ratio of frequencies is a rational number. This phase shift is small if k is small.

If the ratio of the input frequency to the limit cycle frequency is less than $1/5$, the coefficients of the first three terms of the power series of the describing function will not be a function of frequency. If k is sufficiently small, the first term of this power series is an adequate representation of the describing function.

The conditions for the existence of one or more stable limit cycles are discussed and a graphical method for finding the frequency of these limit cycles in terms of the parameters of the linear portion of the control system is presented. Sufficient conditions for operation in a specific limit cycle are given when the linear portion of the control system is such that more than one stable limit cycle is possible. These sufficiency conditions are applied to a system which is capable of oscillating in one of two stable limit cycles.

Some analog computer studies were made to verify the results obtained in a system which contains two stable limit cycles. Studies were also made to verify the insensitivity of such a system to variations of gain in the forward loop.

Microfilm \$2.75; Xerox \$4.60. 89 pages.

ANALYSIS OF A NON-LINEAR CIRCUIT

(L. C. Card No. Mic 60-6765)

John William Hammann, Ph.D.
Washington University, 1960

Chairman: Dr. R. J. W. Koopman

This study is an investigation of the mathematical problem presented by a non-linear network composed of transistors, capacitors, resistors, and an inductor. The elements are connected together to form a push-pull oscillating circuit and the analysis provides an analog computer solution to the resulting simultaneous differential equations. The point of view is that of the large-signal case.

Basically, the problem begins with the method of expressing the operation of the transistors in a mathematical form suitable for use on the computer. Recourse is had to equations developed by Ebers and Moll for transistors in the large-signal mode of operation. These equations express the voltages across the junctions in a transistor as logarithmic functions of the currents at the collector and at the emitter terminals. To test the accuracy of the equations for the transistors at hand, a simple common-emitter circuit was established having two loops and provided with sources of electromotive force for the base and for the collector circuits. The currents in these two circuits were calculated for various values of voltages at the terminals of the transistor. The solution to the simultaneous logarithmic equations was accomplished by a procedure known as the Newton-Raphson method. After the currents were determined, their values were compared with specified values for corresponding conditions of operation. It was concluded that the logarithmic equations would satisfactorily express the operation of the transistor under dynamic conditions.

Once found suitable, the transistor equations were adapted for use in the analog computer and then incorporated in a loop-current analysis of the circuit. Seven loops were required. The resulting seven integro-differential equations with variable coefficients were then established on the problem board of an analog computer and solutions obtained as waveforms for the loop currents. To check the accuracy of the solutions, the currents in various parts of the actual oscillating circuit were measured using suitable instruments. In addition the waveforms as displayed on a cathode-ray oscilloscope were photographed. In this manner computed data could be compared with instrument data at various locations in the circuit; further, the waveforms while operating could be compared with the waveforms obtained from the computer.

The inductor in the circuit was a small single-phase shaded-pole motor. With circuit oscillating at line frequency, the motor was loaded in a suitable dynamometer and its torque output was measured.

The principal findings of the dissertation are as follows: first, that it appears feasible to simulate the operation of a transistor on the computer by means of known logarithmic relationships. These relationships, suitable for the large-signal case, may be included in mathematical circuit expressions thus permitting the analog solution of a certain class of transistor connections. Second, that once a particular circuit has been connected on the computer problem board, the effects of

changes in circuit parameters and transistor gain may be readily studied. Transistors which have not yet been developed may be simulated and their effect on circuit performance observed. Third, that by using a special circuit, a small auxiliary motor of the alternating-voltage type may be successfully energized and operated from a continuous-voltage source.

Microfilm \$2.75; Xerox \$7.80. 170 pages.

LOGICAL SCHEDULING OF A MULTIPLEXED DIGITAL CONTROLLER

(L. C. Card No. Mic 60-6735)

Eugene Walter Henry, Ph.D.
Stanford University, 1960

This investigation concerns problems which arise when several dynamic processes are controlled simultaneously by a single digital computer. Although each process operates as a sampled-data control system, multiplexed operation may cause the sampling intervals to be periodically time-varying or cyclic. Several methods for the analysis of cyclic-sampled systems have been published with the aid of the state transition concept and matrix notation. Here, several methods of synthesizing a digital controller program for a cyclic-sampled system are derived. One design yields a system which exhibits an error transient of finite duration in response to polynomial inputs. Another procedure yields a controller which minimizes a weighted quadratic function of the system error states and the process input energy. The latter design is extended to include control of multi-input processes. The digital controllers for these cyclic-sampled systems are described by linear difference equations with periodically time-varying coefficients. Both state-feedback and error-sampled systems are discussed.

In addition to the design of cyclic-sampled systems, the scheduling of a multiplexed controller which maintains conventional constant period sampling for each process is discussed. Elementary concepts of number theory and combinatorial analysis are used to find all possible sets of sampling periods which satisfy the constraints that each of the processes being controlled by the computer in a sequential manner operates with a constant sampling period and that the computer computation time is fully utilized.

Design considerations for an error-adaptive multiplexed digital controller are also discussed. In such a system it is assumed that each process may operate in either a "normal" or a "disturbed" condition. The computer is programmed to change the various sampling periods as a function of these process conditions so that the over all system performance is improved. Techniques are given for minimizing transient effects which may arise when a process sampling rate is changed abruptly.

Microfilm \$2.75; Xerox \$6.80. 141 pages.

APPLICATION OF THE MAGNETORESISTANCE EFFECT TO ANALOG MULTIPLICATION

(L. C. Card No. Mic 60-6737)

John MacKenzie Hunt, Ph.D.
Stanford University, 1960

The resistance of metallic bismuth, at room temperature, nearly doubles when placed in the field attainable with a conventional iron-core electromagnet. This magnetoresistance effect may be utilized to construct an electronically controlled attenuator which may be employed for modulation or analog multiplication. The accuracy of such a device, used directly, is limited, but may be increased by feedback from the second magnetoresistance attenuator which is identical to but electrically isolated from the first attenuator, both magnetoresistors being subject to the same control field. The accuracy of the system for high feedback-loop gain is limited only by the degree to which the two attenuators approximate identity to one another; this desired degree of identity of characteristics is called tracking accuracy.

Errors in a multiplier employing paired magnetoresistors are shown to result from errors in circuit resistors, drifts in associated amplifiers, loading effect, unavoidable fixed resistance in series with the magnetoresistors, and tracking error of the magnetoresistor pair under varying magnetic field intensity or in the presence of temperature differential resulting from unequal electrical power input to the two attenuator circuits. Linear, and quadratic, components of error versus magnetic field strength may be eliminated by the acceptance of a non-unity scale factor for output, and by deliberate addition of a suitable resistance in series with one of the magnetoresistors, respectively. Temperature differential error may be reduced to an arbitrarily low level by provision of an efficient heat sink or by restriction of rated input power. Loading errors are shown to be of negligible significance under readily attainable circuit conditions.

Tests conducted on thirty-three paired magnetoresistors indicate an attainable accuracy of 0.077 per cent of two-quadrant full-scale output; of this error, drift and resistor error, for typical production components, contributes 0.044 per cent, temperature differential error (for 100 milliwatt rated input) 0.0205 per cent, and magnetic tracking error for the magnetoresistor pair 0.0125 per cent. It is believed entirely possible to reduce the total error to 0.01 per cent by careful control of all error-producing elements.

Frequency response of the multiplier is fundamentally limited by the ratio of magnetic energy stored in the core air gap to available coil excitation amplifier output, as gap energy must be alternately stored and removed in the form of excitation volt-amperes. Because of the above mechanism of frequency limiting, the attainable response is inversely proportional to the magnitude of the alternations of the variable associated with field control; for small signals an appreciable improvement in frequency response is possible. Phase shift up to the limiting frequency may be maintained at virtually zero if sufficiently high gain is employed in the feedback control loop. A multiplier of the approximate dimensions and control power requirements of a small servo multiplier exhibits a full-signal frequency response of five cycles per second.

The magnetoresistance multiplier is completely free

from the highly objectionable non-linear anomalies of the servo multiplier which it closely resembles. The anomalies of the servo multiplier result from finite potentiometer resolution, static friction, and backlash, and can result in large errors in the dynamic solution of differential equations. The magnetoresistance multiplier is believed to offer greater potential reliability than the majority of multipliers now in use.

Magnetoresistor pairs can be made by conventional micro-circuitry techniques such as electroplating, photo-etching, or vacuum evaporation. Consideration of the known characteristics of magnetoresistance materials and the quantitative factors which limit multiplier performance and accuracy suggest the possibility of attainment of significant improvement over the results of this study by operation of bismuth elements at liquid nitrogen temperature or by the use of elements employing intermetallic semiconductor material.

Microfilm \$2.75; Xerox \$6.40. 133 pages.

DEVELOPMENT OF AN OBJECTIVE INSTRUMENT FOR EVALUATION OF SCIENTIFIC MATURITY IN ELECTRICAL ENGINEERING

(L. C. Card No. Mic 61-512)

Sakari Tapani Jutila, Ph.D.
Syracuse University, 1960

The theme of this dissertation is based on the following assumption: In the era of rapidly evolving scientific technology a fundamental long range goal of science and engineering education is to impart a non-inert and creative knowledge based on an understanding of basic meanings and relationships, of a general rather than specific nature. Namely, this type of understanding allows one to adapt himself to the rapidly varying situations dictated by the changing technology. With this in mind, scientific maturity is defined as being characterized by a non-inert, open-to-review knowledge of the scientific method. This maturity presupposes a competent level of understanding of meanings and applicability of a set of natural laws for various novel situations that may arise in science and engineering. In contrast, scientific immaturity is characterized by an inert adherence to "set methods" that are obviously applicable to commonly known stereotyped problem situations. It is also characterized by a confusion of scientific competence with knowledge of specifics, and a mere encyclopedic knowledge without a connecting conceptual framework.

In the Department of Electrical Engineering at Syracuse University the MEE degree is defined as a research degree whose quality presupposes a level of scientific maturity. Oral exams have been conducted for an evaluation of students' level of maturity for MEE candidacy but these exams have been criticized for their lack of reliability and for variability of standards. Therefore, an objective instrument CPM-2 was developed to test students' levels of a non-inert understanding of general concepts and principles in the science of Electrical Engineering. This instrument consisted of 26 multiple choice items. For each item, the correct choices were designed

to appeal to relatively matured students whereas the distractors were made attractive to those who think in terms of various popular misconceptions, stereotyped situations, and inaccurate thought processes.

The content of CPM-2 was taken from the current EE undergraduate and MEE graduate curricula with an emphasis on physics, mathematics and electrical engineering topics. The score for a correct choice was +3, for an incorrect choice -1, and for no answer zero. Thus the minimum total score was -26 and maximum total score +78. The expected total score by random guessing was zero.

The positive correlation 0.4 between the CPM-2 scores and both the grade point averages and oral exam scores for 60 MEE-program students was considered as an evidence of validity since relatively matured students are expected to perform better in their courses and oral exams than relatively immature students. For 43 EE Seniors the correlation between their CPM-2 scores and cumulative undergraduate grade point averages was 0.5, constituting by the same assumption an additional evidence of validity. It is expected that MEE-program students who have finished at least half of their required course work in the program are by and large more mature than Seniors. For 123 such MEE-program students the average CPM-2 score was about 20 whereas for 43 EE Seniors the average score was only 10. The average score for 17 Seniors with grade point averages equal to or greater than 1.8 was 16. A student opinion survey produced some "immature" opinions corresponding to high grade point averages but low CPM-2 scores. Also an MEE-program student with a marginal grade point average produced a high CPM-2 score that correlates with his mature thesis work.

The consistency of the CPM-2 instrument was tested by applying it to two disjointed MEE-program student populations of supposedly equal general maturity level. Each population had about 60 students. The resulting average scores turned out to be 19 and 21.

The error of an individual CPM-2 score is discussed in terms of a statistical model that takes the effect of random guessing into account. The error for the score of an average student in a population of 60 MEE-program students turned out to be 9.5. The error was also calculated by finding the standard deviation of scores in the above population, and by determining the Spearman-Brown reliability coefficient. This calculation yielded 9 as the value of the standard error of an individual score.

The effect of the number of items in the instrument was discussed. A threshold score was found for 26 items in the instrument such that about one out of eight average students in a population of 60 MEE-program students would fail, and about one out of eight students guessing randomly would pass with respect to this threshold. If the test was made 56 items long, one out of twenty average students would fail and one out of twenty randomly guessing students would pass with respect to the new threshold score.

The possibility of developing instruments similar to CPM-2 for evaluation of entering graduate students and students for Ph.D. candidacy is suggested. Also, various alternatives are given for using CPM instruments in conjunction with oral exams for MEE qualifying exams.

The use of instruments like CPM is suggested for tools of instruction and learning. Student opinions indicate a need of improvement in learning habits and goals. The

diagnostic value of CPM-2 has been suggested by EE Seniors and some MEE-program students.

In conclusion it is pointed out that an instrument like CPM-2 need not be restricted to the area of Electrical Engineering Science, but that similar instruments should be developed for other areas of science education.

Microfilm \$2.75; Xerox \$5.60. 111 pages.

A COMPREHENSIVE ANALYSIS OF TRANSIENT RESPONSE OF JUNCTION TRANSISTORS

(L. C. Card No. Mic 61-518)

Rajendra Pranlal Nanavati, Ph.D.
Syracuse University, 1960

An attempt has been made in this work to extend the analysis of transistor transients as given by Ebers and Moll. Their analysis concerned itself with only three output transient times--rise, storage, and fall times. There were two additional important restrictions on their analysis. First their analysis required the load resistance to be low enough so that the effect of the nonlinear collector junction capacitance could be neglected. Second the validity of their analysis required the collector junction to recover before the emitter junction.

The analysis in this work considers both output as well as input transient times. It is shown that a fourth output transient time, the output delay time, is of importance in considering the total turn on time for a transistor. Analysis is presented which allows the prediction of the delay time, and which takes into account the nonlinearity of the emitter junction capacitance.

The restriction on low load resistance values is removed and expressions for rise and fall times are derived which take account of the nonlinearity of the collector junction capacitance. Small signal equivalent circuits of transistors operated in common base and common emitter mode while they are saturated are derived. A careful examination of these equivalent circuits indicates that the cut off frequency for Z_{21e} (common emitter) is related to the storage time constant T_s . It is further shown that T_s is the fundamental device parameter whose knowledge enables the prediction of output storage time. Several methods of measuring T_s are discussed and compared with each other.

The time dependent diffusion equation is solved for the minority carriers in the base region under transient conditions. Through the solution transient turn off times are calculated even when the emitter junction recovers before the collector junction. The solution is further shown to several certain correlations between input and output transient times. Conditions under which these correlations are true are discussed. These correlations are of interest because measurements made on the input may be used to deduce the output transient times. There are many circumstances under which the input transient times are easier to measure than output transient times.

In connection with each transient time experimental data is presented which testify to the validity of the theories developed.

Microfilm \$2.75; Xerox \$5.60. 115 pages.

A SIMPLIFIED METHOD OF SYNTHESIZING LADDER NETWORKS WITH IMAGE-PARAMETER HALF-SECTIONS

(L. C. Card No. Mic 60-6687)

David Silber, Ph.D.
The University of Florida, 1960

The problem of designing a filter is to synthesize a network having a prescribed insertion loss characteristic.

There are two different methods of filter design available. The older one, developed by Zobel, is based on image parameter theory. The newer method, originated by Darlington, is based on insertion loss theory.

The outstanding feature of the image parameter design method is its simplicity, which stems from the "building block" structure of composite filters. The image transfer coefficient is an approximation to the quantities of interest, the insertion loss and phase.

The insertion loss method is more flexible and sophisticated than the image parameter method. With this method optimum filters can be synthesized. Disadvantages of this method are (1) longer design time and (2) a good background in circuit analysis (usually taught in graduate curricula) required of design engineers.

The purpose of this dissertation is to develop a new method of synthesis of ladder networks which is comparable to the insertion loss method in flexibility and to the image parameter method in simplicity.

By this method a ladder network is synthesized with "elementary building blocks" consisting of image parameter half-sections with common cut-off frequency. The obtained ladder may be considered as a tandem connection of image parameter half-sections, the image impedances of which do not match each other at the points of interconnection (as opposed to the Zobel filter for which matching is a fundamental design requirement). It may be remarked here that a majority of hereto proposed modifications for improvement of the Zobel filter were concerned with methods of improved matching. The amount of mismatch between half-sections determines the insertion loss characteristic in passband and affects the minimum attenuation in stop band.

The image parameters for elementary building blocks, which give ladder filters with desirable insertion loss characteristics, are derived in terms of the poles and zeros of the insertion loss functions. The Butterworth, Tchebycheff and elliptic function two-section filters are considered; numerical values of the image parameters for these filters are computed by the use of an electronic computer. These data and graphs (as well as derived formulae) can be used by design engineers unfamiliar with modern network theory for designing filters obtainable by the insertion loss method.

Based on the analysis of the numerical data, an improvement of Zobel filters is suggested by a mismatch of its half-sections corresponding to the mismatch found in Tchebycheff and elliptic function filters.

Microfilm \$2.75; Xerox \$4.60. 88 pages.

THE USE OF NOSE WHISTLERS
IN THE STUDY OF
THE OUTER IONOSPHERE

(L. C. Card No. Mic 60-6748)

Robert LeRoy Smith, Ph.D.
Stanford University, 1960

Electromagnetic energy at very low frequencies can be propagated from one hemisphere to the other along the earth's magnetic field lines in the outer ionosphere. The action of free electrons disperses the original impulse-like signal (from a lightning discharge) to form descending gliding tones, called whistlers. If the highest frequency of the whistler is comparable with the minimum electron gyrofrequency along the propagation path, the dispersion at the higher frequencies causes rising tones which are contiguous with the descending tones at the lower frequencies. The whistler is then called a "nose" whistler.

Spectrographic analysis of whistlers and nose whistlers often reveals a number of pure isolated components which have a common source. Examination of whistler data and a new theory of the propagation path lead to the conclusion that each component represents energy from the lightning source which has been trapped in a field-aligned column of enhanced ionization in the outer ionosphere. The data indicate that the lifetime of these columns is a few hours. The theory suggests that enhancements of approximately five per cent are sufficient to explain the observed whistlers. The theory further indicates that the average group velocity of energy trapped in a column can be closely approximated by assuming that the energy travels along the maximum of ionization in the column with wave normals aligned with the magnetic field.

The frequency of minimum time delay, called the nose frequency, indicates the location of the field line path. The minimum time delay gives a measure of the ionization density in the region near the top of the path. Examination of nose whistler data from a number of stations leads to a model of electron density in the outer ionosphere. The data also show an annual variation of 2:1 in the ionization density during sunspot maximum.

Microfilm \$2.75; Xerox \$6.20. 128 pages.

NONLINEAR CONTROL SYSTEM STABILITY
VIA THE SECOND METHOD
OF LYAPUNOV

(L. C. Card No. Mic 60-6240)

La Mar K. Timothy, Ph.D.
University of Utah, 1960

Chairman: L. Dale Harris

The thesis presents the fundamental concepts of the "Second Method of Lyapunov" in a manner which can be applied to the investigation of control system stability by analytical techniques. These concepts are presented on a level sufficient for engineering purposes; the rigor is left to the mathematician. More specifically, a philosophy is presented for constructing a Lyapunov function for asymptotic stability.

In addition, a specific nonlinear control system is treated by the Lyapunov method to determine a region of stability. This control system is of a nature that can not be investigated by phase-plane or describing-function techniques. Microfilm \$2.75; Xerox \$3.60. 65 pages.

ENGINEERING MECHANICS

THE LOCATION OF MAXIMUM STRESS
IN BARS WITH FILLETS
UNDER COMBINATIONS OF BENDING
AND DIRECT SHEAR

(L. C. Card No. Mic 61-91)

Edward Louis Broghamer, Ph.D.
University of Illinois, 1960

In the technical literature dealing with stress concentrations in members containing fillets little is said concerning the location of the maximum fillet stress, the parameters exerting an influence on the location or any physical explanation of the reason for changes in location. Analytical solutions for many of the simplest members are non-existent due no doubt to a lack of knowledge of the boundary conditions.

With the increasing importance of optimum design it is essential to arrive at a more extensive knowledge of the parameters and basic phenomena controlling the maximum stress. Experimental investigations have been directed at the determination of the magnitude of the maximum stress. Analytical solutions for the magnitude of the stress have been developed for some simple two and three dimensional cases. In most of the foregoing analytical solutions an essential element is knowledge of the location of the maximum principal stress in the region of the discontinuity. More extensive knowledge in this area could lead to the extension of the analytical approach to a broader range of members.

In this thesis the location of maximum stress in bars subjected to combinations of bending and shear have been determined experimentally using photoelastic techniques. Several parameters were studied in conjunction with the loading variations. A total of 13 models were used in this investigation. The models were designed to cover a limited range of parameters with the intent of exploring the nature of their effect and if possible the predominant one or ones in the location of the maximum fillet stress. Fringe photographs were analyzed and the results for prismatic bars with full fillets shown as curves for several r/d ratios.

The investigation disclosed that in a member subjected to pure bending the maximum stress is located much closer to the point of tangency of the fillet and the bar surface (i.e. reference section) than when the same member is subjected to bending combined with shear. The magnitude and the position of the applied bending moment, unless proximity effects are introduced, have no effect on the location.

In all members irrespective of the type of loading the r/d ratio is an important parameter. This investigation

disclosed that the maximum stress was located further away from the reference section as r/d became smaller. In the range used in this investigation this could be as much as 32° depending on the V/M and r/d ratios.

Members having a fillet angle less than 90° were found to have the maximum stress located slightly nearer to the reference section than those members having full fillets, although in the range investigated the difference was relatively insignificant. Members having fillet angles greater than 100° (i.e. fillet extending beyond the reference section) have the maximum stress located at the reference section when subjected to pure bending but when subjected to combined bending and shear the location with respect to the reference section is the same as that for full fillet members.

The foregoing statements contain the most important direct conclusions which can be arrived at on the basis of the investigations conducted. However, on a qualitative basis it appears that the results of this thesis and of some previous work along similar lines indicate that the shearing stresses are a dominant factor in the location of the maximum stress. This leads one to believe that the basic mechanism of load transfer in the vicinity of geometrical discontinuities of this type is the shearing stresses.

Microfilm \$2.75; Xerox \$3.00. 47 pages.

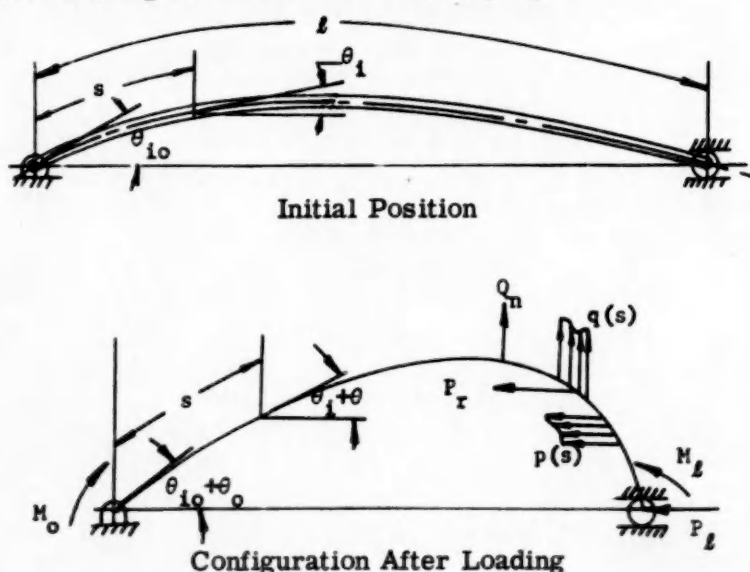
ANALYSIS OF SIMPLY SUPPORTED ELASTIC BEAM COLUMNS WITH LARGE DEFLECTIONS

(L. C. Card No. Mic 60-6722)

Harvey DeVon Christensen, Ph.D.
Stanford University, 1960

The objective of this paper is to establish a general procedure for the determination of shear, bending moment, inclination of the elastic axis and deflection for a simply-supported elastic beam column with an initial curvature. The procedure uses the averaging method of W. Ritz to obtain an approximate solution of the nonlinear differential equation. This "Ritz solution" provides a starting point for a numerical trial and correction solution.

A simply-supported elastic beam-column before and after loading is shown in the following figure:



The structural member has an arbitrarily varying cross-sectional area and an arbitrary initial shape as shown in the figure. The arbitrary loads are: $Q_1 \dots Q_n$, concentrated lateral loads; $P_1 \dots P_r$, concentrated axial loads; P_l end load; M_0 and M_l end moments; $q(s)$ distributed lateral load; and $p(s)$ distributed axial load. The applied loads are arbitrary except for the restriction that the induced stresses in the structural member are assumed to be within the elastic range of the material.

The formulation of a mathematical model of the simply-supported elastic beam column leads to the following differential equation

$$\frac{d}{ds} (EI\theta') + P \sin(\theta + \theta_i) - V \cos(\theta + \theta_i) = 0$$

where

E = modulus of elasticity

I = moment of inertia of the cross section

P = horizontal component of the internal force in the beam

s = distance along the elastic axis of the beam column

V = vertical component of the internal force in the beam

θ = change in the angle of inclination of the elastic axis due to the applied loads

θ_i = initial angle of inclination of the elastic axis due to the initial shape

$$\theta' = \frac{d\theta}{ds}$$

This equation is a second order nonlinear differential equation with variable coefficients. The known boundary conditions are

$$\left. \frac{d\theta}{ds} \right|_{s=0} = \frac{M_0}{EI_0} \quad \text{and} \quad \left. \frac{d\theta}{ds} \right|_{s=l} = \frac{M_l}{EI_l}$$

where M_0 and M_l are the applied couples at the ends of the beam.

In Chapter 1 of the paper the foregoing differential equation, which describes the static displacement of a simply-supported elastic beam column, is derived. In addition, this chapter presents the essential ideas of the averaging method of W. Ritz. The Ritz method is used to obtain approximate solutions of linear and nonlinear beam column problems in Chapters 2 and 3 respectively. When possible, the approximate Ritz solutions are compared to known solutions. The general trial and correction procedure for the analysis of beam column problems is presented in Chapter 4. Also, the practicability and utility of the trial and correction procedure are demonstrated in this chapter.

Solutions of nonlinear cases are accurately determined where deflections of the elastic axis are as large as 40 per cent of the length of the beam column. In the last section of Chapter 4 the results of twenty-eight solutions are presented. These solutions were obtained by the use of an ALWAC111E electronic digital computer.

Microfilm \$2.75; Xerox \$5.20. 103 pages.

VIBRATION OF SHELLS HAVING INITIAL STRESSES

(L. C. Card No. Mic 61-106)

Roy Rochester Craig, Jr., Ph.D.
University of Illinois, 1960

The theory of shells is applied to the problem of the vibration of shells which have initial stresses prior to vibration. Expressions for the membrane energy, the bending energy, the supplementary energy due to the initial stresses, and the kinetic energy are given for shells which have orthogonal coordinates. Some aspects of the theory of vibration of flat plates are considered in greater detail by the introduction of an Airy stress function. Rayleigh's method is used to determine upper bounds for the natural frequency of the plates, and Southwell's method is adapted for the determination of the lower bound. Finally, the terms involving initial stresses are considered to be first-order perturbations in the equations of motion for plates, and perturbation techniques are used to determine the natural frequency and mode shape of the perturbed plate. It is shown that in some cases the initial stresses may be determined if the natural frequency and mode shape are known.

Microfilm \$2.75; Xerox \$4.20. 77 pages.

SPECIAL METHODS IN THE TREATMENT OF SOME PLANE ELASTICITY PROBLEMS (WITH PARTICULAR REFERENCE TO THE STUDY OF DAMS AND PRESTRESSING)

(L. C. Card No. Mic 60-6548)

Robert William Gerstner, Ph.D.
Northwestern University, 1960

Supervisor: Dr. O. C. Zienkiewicz

In the field of elasticity exact solutions can not be obtained for a vast majority of problems of considerable importance in engineering. Many of such problems have been solved by the use of finite difference and relaxation techniques. It is the purpose of this dissertation to extend these methods to special classes of problems which arose in a study of gravity and prestressed dams, and, in particular, to develop two special techniques with a wide range of applicability.

The first technique concerns the case where an interface divides a body sharply into two sections having different elastic properties. The boundary conditions which would have to be satisfied by the Airy stress function on that portion of a boundary for which the displacements are specified, are derived, as well as similar conditions for an elastic interface with perfect bond. These relations are believed to be new and show some analogies with the boundary conditions of transversely loaded plates as could be anticipated from aspects of the analogy already known. The procedure is particularly useful when stresses are specified on the boundaries.

The second technique is a procedure which utilizes known elasticity solutions and applies a finite difference correction to obtain the complete solution. The derivation

follows readily from the previous discussion. The method presupposes that it is possible to find simple, closed form solutions which are capable of satisfying all equilibrium conditions within the body under investigation, and which, in addition, satisfy elastic compatibility conditions everywhere except on some interface line within the body. To obtain a complete solution in such a case it is only necessary to perform a correction computation, which, when superimposed on the original solutions, restores continuity on the interface. This procedure is applicable to problems involving singularities and unbounded regions.

The two methods are then applied to the solution of some problems of engineering significance. These include: a study of the effect of a wide range of elasticity ratios on the stress distribution in gravity dams, an investigation of the effect of anchorage depth on the stress distribution in prestressed dams, a determination of the thermal stress distribution in a body with a discontinuous coefficient of expansion, and, an investigation of anchorage zone stresses in a post tensioned prestressed member. Details of the derivations are given as well as numerical results.

Microfilm \$2.75; Xerox \$6.20. 130 pages.

INTERNAL FRICTION OF ZINC SINGLE CRYSTALS

(L. C. Card No. Mic 61-41)

George John Hasslacher, III, Ph.D.
The Pennsylvania State University, 1960

The internal friction or damping of materials is caused by a number of different mechanisms. One of these mechanisms is the motion of dislocations in metals. In this thesis a modified theory of dislocation damping which includes the effects of strain amplitude and temperature upon the damping was developed. In order to check the validity of this theory and other existing theories experiments were conducted to determine the strain and temperature dependence of damping in zinc single crystals.

The theory uses the Koehler analogy between the vibration of a dislocation line segment pinned down by impurity atoms and the problem of the forced damped vibration of a string. The exact solution of the differential equation of motion was obtained and then employed to calculate the damping due to one dislocation loop. Assuming a random distribution of impurity atoms and large pinning agents a distribution function for the lengths of the various dislocation loops was obtained. Using this distribution function the total damping due to the motion of the dislocation lines was calculated. The strain amplitude dependence of the damping was derived by finding the increase in loss which occurs due to the loops breaking away from the impurity bonds when the loop tension exceeds the Cottrell bonding force. By considering the effect of temperature on the Leibfried damping and the Cottrell locking force the temperature dependence of the damping was obtained.

The theory predicts a constant damping with respect to strain until a critical strain is reached. At this critical strain the damping begins to increase very rapidly with strain and approaches a constant value at very large strains. An increase in temperature results in a general

increase in the damping and a reduction in the critical strain.

For the experimental work single crystals of 99.9993 per cent pure zinc were produced in a modified Bridgeman type furnace constructed especially for this study. An experimental apparatus for measuring the damping of long slender specimens was designed and constructed. The apparatus is capable of measuring damping at strains from 10^{-9} to 10^{-3} at temperatures from 70 to 420 degrees Kelvin.

Using the resonance curve method the damping of zinc single crystals was measured as a function of strain and temperature. Results were obtained for strains from 10^{-9} to 10^{-5} and for temperatures from 25 to 100 degrees Centigrade. For very small strains (10^{-9}) a Q^{-1} of 10×10^{-4} was obtained at 25 degrees Centigrade. At 100 degrees Centigrade the Q^{-1} was 30×10^{-4} for small strains. At large strains the Q^{-1} reached 600×10^{-4} .

The theoretical predictions and experimental results were found to be in general agreement. The breakaway of the Cottrell bond was shown to be the source of the strain amplitude dependence of the dislocation damping. The differences between the theoretical and experimental temperature dependence were noted and discussed.

Microfilm \$2.75; Xerox \$5.20. 104 pages.

THE APPLICATION OF IMPEDANCE METHODS TO MECHANICAL VIBRATION PROBLEMS

(L. C. Card No. Mic 60-6622)

Elmer LaVerne Hixson, Ph.D.
The University of Texas, 1960

Supervisor: Dr. A. W. Straiton

The application of impedance methods to mechanical systems is surveyed and it is noted that use as an analysis tool is extensive, but little attention is given to equivalent systems and their determination from physical measurements. Equivalent systems are emphasized here, but a complete development is given, based on the generally accepted definition for impedance; i.e., force divided by velocity. A circuit concept is established, basic theorems are presented and π and T equivalent circuits are introduced. Classical impedance analysis methods are covered and extensions are made to non-sinusoidal, shock and random excitation by the Fourier Series and Integral methods and the generalized impedance method employing the LaPlace Transformation.

The requirements for measuring devices are discussed and several are described. The construction and calibration methods for the impedance head used in this work are also described.

From the measured impedance and free velocity, the characteristics at a point on a simple structure are represented by an equivalent circuit. The structure included a source of vibrational energy to model a ship frame, an air frame, or a missile frame. The motion of an element connected at the measurement point is predicted and verified by measurement. In a second example, the shock response of a resiliently supported mass is determined by equivalent circuit methods and compared to the meas-

ured motion wave shape. In a final example, the problem of vibration isolation for a small electric motor to be attached to a non-rigid base plate is considered from the impedance viewpoint. An isolator was designed, the expected motion of the plate predicted, and this motion measured. The results are predicted with a degree of accuracy sufficient for most engineering applications.

Microfilm \$2.75; Xerox \$6.20. 130 pages.

ENGINEERING, METALLURGY

REPROCESSING OF URANIUM FUELS BY SELECTIVE OXIDATION-REDUCTION REACTIONS IN A FUSED SALT-LIQUID METAL SYSTEM

(L. C. Card No. Mic 61-464)

Sidney John Stephenson Parry, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Premo Chiotti

Investigations were made on the pyrometallurgical separation of uranium from thorium, protactinium and fission products by selective oxidation-reduction reactions. Special emphasis was placed on a process which would be of particular interest to the purification of uranium-233 generated in the thorium-uranium-233 fuel cycle. However, the process investigated is of interest in the removal of impurities from uranium regardless of its origin.

$ZnCl_2$, as a solute in the KCl-LiCl eutectic, preferentially oxidized uranium, thorium and certain fission products from a zinc solution. Other fission products present remained in the zinc phase. Magnesium, in a zinc solution, reduced the chlorides and caused precipitation of various metal-zinc compounds.

Starting with thorium dissolved in magnesium, followed by precipitation of the only slightly soluble uranium, which was then dissolved in zinc, oxidized by $ZnCl_2$ and finally reduced by magnesium, essentially complete separation of contained cerium, yttrium, niobium and molybdenum was observed. It is proposed that those fission products of similar chemical nature, namely all alkali, alkaline earth, rare earth, noble, and low and high melting fission products can be similarly separated.

Controlled additions of $ZnCl_2$ or magnesium caused the selective removal of uranium from zirconium when carried in either liquid zinc or fused salt phases. Further, the removal of contained zirconium from fused salts by selective distillation was demonstrated. Complete separation of either thorium or protactinium was not observed, but partial removal of thorium by either selective distillation or oxidation-reduction reactions was shown.

The observed oxidation state of uranium, thorium and cerium when in fused chloride salts in contact with liquid zinc is shown to be plus 3. Evidence as to the oxidation state of zirconium under similar circumstances is somewhat conflicting, but suggests that an equilibrium between plus 3 and plus 4 zirconium exists, with both species being present in appreciable concentrations.

Suggestions are made as to the possible extension of similar reprocessing systems to plutonium or oxide bearing reactor fuels, or to the recovery of scrap materials containing uranium.

Microfilm \$2.75; Xerox \$9.45. 206 pages.

ENGINEERING, SANITARY AND MUNICIPAL

BIOLOGICAL UPTAKE OF RADIOACTIVE NUCLIDES BY CLAMS

(L. C. Card No. Mic 60-6662)

Melvin W. Carter, Ph.D.
The University of Florida, 1960

Discharges of potentially hazardous radioactive wastes into marine environments can result in situations involving the public health. Experimental studies are needed to examine any number of complex related problems including accumulation of hazardous radionuclides in seafoods utilized by man as food and to evaluate these marine organisms as possible indicators of radioactive pollution of marine areas.

Laboratory investigations involved uptake, accumulation and retention of three fission products and one neutron-induced radionuclide of public health significance by an edible clam, *Venus mercenaria*, contained in continuously aerated, filtered sea water.

Ruthenium was taken in by clams in relatively low levels but subsequently released to the environment. Radioactivity levels in tissues decreased while an available supply of ruthenium was maintained in environmental medium. Such response was attributed to an aversion reaction.

Clams rapidly accumulated cerium and promethium in soft tissues and shell cavity fluid. Accumulation by shell (internal) was continuous but at much lower levels. Concentration ratios (c/m/gm of dry tissue divided by average initial and final medium radioactivity in c/m/ml) for external shell reached values of between 800 to 1,000 after 14 days exposure to radioactive cerium or promethium.

For external shell, experimental data could be represented by an adsorption equation of the form:

$$A = \frac{abt}{1 + at}$$

where A = activity/unit weight at exposure time, t, and a and b are experimental constants.

Soft tissues retained cerium or promethium in amounts greater than 63 per cent of that accumulated during a two weeks' dosing phase following immersion of contaminated clams in fresh undosed sea water for 14 days. Accumulation of these materials was attributed to a substitution mechanism.

The accumulation of Co^{60} by soft tissues was suggestive of vitamin B₁₂ incorporation. Soft tissues retained approximately 65 per cent of the associated Co^{60} following a two weeks' immersion of contaminated clams in undosed sea water. Accumulation by shell was continuous through a 17-day exposure period. The accumulation of Co^{60} by old shell (external) was caused primarily by algae and perhaps bacteria on the shell. Adsorption or ion exchange undoubtedly participated in this association.

Co^{60} and Pm^{147} became readily associated with *Platymonas* within 24 hours. Spiked cultures of such cells were fed to clams and accumulation for each material studied. Results resembled those obtained using the radioelements themselves. Accumulation of these materials in soft tissues appeared to be more rapid and effective when using spiked food cells. However, accumulation of cobalt alone, although at a slower rate, eventually reached higher tissue levels.

Accumulation of Pm^{147} by shell, soft tissues and old shell at four days was related to environmental levels of promethium. Each such relationship could be expressed as a power function.

Studies using detached shells and various shell treatments such as cleaning, ultraviolet and blue vitriol were made to supplement and amplify those for living specimens.

Supplementary data were collected on background radioactivity levels in clam tissues and sea water, weight distribution of clam tissues, moisture content of soft tissues, pH of shell cavity fluid and effects of salt concentration variation on pumping activities of clams.

Public health implications of radioactivity levels reached in edible portions of clams are discussed for selected data. Cerium was most restrictive in that maximum safe daily intake of contaminated clam tissues by humans amounted to less than two grams.

Venus mercenaria would be useful as indicators of radioactive contamination of their marine environment for many types of nuclear wastes which are being produced and discharged. External testaceous material may be of greater value for the collection and identification of radiocontaminants especially for low level radioactivity assessment.

Microfilm \$2.75; Xerox \$8.00. 173 pages.

SELECTION OF OPTIMUM FILTRATION RATES FOR SAND FILTERS

(L. C. Card No. Mic 61-442)

John LeRoy Cleasby, Ph.D.
Iowa State University of Science and Technology, 1960

Supervisor: E. Robert Baumann

The filtration of water containing particulate matter in suspension was studied on three graded sand filters. The filters were 6 in. ID with a sand depth of 30 in. and

a sand effective size of 0.55 mm. Two types of suspensions were studied both of which are typical of waters encountered in municipal practice. One was a well water containing 7 to 9 mg/l of iron which was aerated and mixed to cause the precipitation of the iron in the form of hydrous ferric oxide particles 1 to 20 μ in size. The other was the filter influent water of a split-treatment lime-soda ash softening plant which contained precipitated calcium carbonate particles 1 to 10 μ in size. Effluent quality from each filter was monitored by a precise continuous reading photoelectric turbidimeter.

The filters were operated simultaneously at different constant filtration rates between 0.7 and 8 gpm/sq ft with the objective of determining the optimum rate of filtration from the standpoint of the maximum volume of acceptable water produced per filter run to a given terminal total head loss.

When filtering suspensions which caused head loss to develop at an increased rate as the filter run progressed, greater production occurred at higher filtration rates. An optimum rate was reached in some cases beyond which further rate increases resulted in reduced production. The optimum rate based solely on production considerations was identified as the lowest rate which resulted in the development of head loss in nearly a linear manner. Fil-

trate quality was not always acceptable at the optimum rate and therefore water quality must also be considered in selecting the operating filtration rate.

No optimum rate tendency was observed when filtering suspensions characterized by linear head loss development at all rates. In this case, higher rates resulted in reduced production to a given terminal head loss.

The reason for the presence of an optimum rate tendency was found to be the formation of a compressible surface cake by that portion of the particles removed from suspension on the sand surface. Head loss in the surface cake developed in an exponential manner, whereas head loss below the surface cake developed in nearly a linear manner.

Various other questions related to the sand filtration of water were studied: (1) The relation between filtrate quality and depth at different rates and at different times during a filter run. (2) The relation between initial filtrate quality and rate of filtration. (3) The behavior of filtrate quality at different filtration rates at the beginning of a filter run. (4) The behavior of effluent quality following a sudden rate increase on a partially dirty filter. (5) The relative merits of constant rate, constant pressure, and variable rate filtration.

Microfilm \$2.75; Xerox \$8.00. 173 pages.

FOLKLORE

POPULAR STAR NAMES AMONG THE SLAVIC SPEAKING PEOPLES

(L. C. Card No. Mic 60-3584)

William Baker Gibbon, Ph.D.
University of Pennsylvania, 1960

Supervisor: Anthony Salys

The purpose of the paper is to present the popular star names as they appear in the several Slavic languages, and to describe the origin of these names, so far as their use by the Slavs is concerned, with the object of demonstrating that the popular astronomy of the Slavic people in most cases is comprised of remnants either of the legends of older civilizations or, in localized areas, of the star myths of neighboring peoples.

There are five major stars, or star groups, known generally throughout the Slavic world: Orion, the Milky Way, the Pleiades, Ursa Major and Venus. Other stars and constellations appear only in localized areas.

Even the major star groups, however, are divided into "motifs," each region having its own name, oftentimes with corresponding legend, for that particular star. Since the majority of Slavic popular star names have been borrowed, almost no single name is found uniformly throughout the entire Slavic language area.

All names may be considered as belonging to one of the four following categories:

(1) Those borrowed names whose exact national origin cannot be determined with certainty. Within this group fall those names having sporadic distribution within the Slavic languages, and for which parallels in large non-Slavic areas are to be found. The latter usually is indicative of a very old origin. Such names designating Orion's belt as the three kings, the three sisters, the yoke, the circling stars; The Milky Way as a road in general, or a belt; The Pleiades as a hen and chicks, women, keys, rain, seven stars; Polaris as the polar star; Ursa Major as a wagon, cart or dipper, belong to this category.

(2) Those borrowed names which, even though the motif may be widely known outside the Slavic world, are localized within the Slavic area, and as such can be traced with a reasonable degree of certainty as to entry point into Slavic. To this group belong Orion's harvest motif (found in those areas peripheral to the German language area; western Poland, Cassubian, Slovenian, northwestern Croatia, Czech, Slovak, Sorbian), the shepherd motif (from the Turkish area of influence, this is prevalent in Serbocroatian and Slovenian), the scales (from the Turkish influence, the name is restricted to Bulgarian); the Milky Way's straw thief motif (from the Turkish, found in Bulgarian and Serbocroatian), the birds' way (from the Finno-Ugrian, prevalent in Russian); the Pleiades' sieve motif (from the Finnish-Estonian, restricted to White Russian and Russian), the ducks (from the eastern steppe tribes, this name is found in Asiatic Russia); Ursa Major's wolf motif (from the Tatars and steppe tribes, found in Bulgarian, Russian and Ukrainian); Polaris' pole motif (from Turco-Tatar, found in Ukrainian, Russian, Bulgarian and Serbocroatian); Venus' golden coin motif (from Turkish, this name was restricted to Bulgarian).

(3) A third category consists of those names which seem to have come into Slavic, as loan translations, through the tradition of the nomenclature of classical languages. This would include Venus as the morning and evening star, the day star or the bringer of light; Ursa Major as the bear; and the Hyades as pigs.

(4) The fourth and final grouping is comprised of those names for which no parallels can be found in other languages, and which must therefore be treated as originally Slavic. Most names are restricted to very small areas, such as the Serbocroatian names šokčići and kupioci, designating the Pleiades.

The second group constitutes the majority of names, the main sources of Slavic borrowing being Germanic in the West and Southwest, Finno-Ugrian in the North, and Turco-Tatar in the East and Southeast.

Microfilm \$3.00; Xerox \$10.60. 231 pages.

FOOD TECHNOLOGY

PREPACKAGED FRESH MEAT CHARACTERISTICS AS RELATED TO QUALITY AND ENVIRONMENTAL FACTORS

(L. C. Card No. Mic 60-6778)

Eugene Birmingham, Ph.D.
University of Missouri, 1960

Supervisor: H. D. Naumann

The expansion for the demand of animal products is of real concern to the animal husbandryman. One important

means of demand expansion is through improved utilization of meat. This may be accomplished by improving the non-eating factors which may affect product acceptance.

A study was conducted to establish some of the basic factors concerning the shelf life of prepackaged fresh pork and beef. These meats varied in quality attributes and were subjected to different environmental treatments. An objective method was developed to segregate cuts into lean firmness classifications.

Loins from 36 pork carcasses were equally divided into three lean firmness groups. Short loins from 20 beef carcasses were equally divided into two lean firmness

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*The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm.
Enlargements 5-1/2 x 8-1/2 inches, 4-1/2 cents per page.*

groups. Slices of the defatted *longissimus dorsi* muscles were prepackaged. These samples were stored up to five days under continuous 60 to 65 foot candles of light intensity at 34° F. (1.1° C.) and 50° F. (10° C.).

A significant correlation was found between the subjective and objective methods of measuring firmness. Firm muscles had more marbling and a higher pH than soft muscles.

The firm pork cuts had a lower total microbial count as compared to the soft beef. However, on the last day of storage at 50° F. (10° C.), the softer group had a higher microbial count.

Soft lean pork cuts lost more weight during storage than the firm lean cuts held under similar conditions. Beef muscle firmness was not significantly associated with the amount of prepackaged shrinkage. As temperature and duration of storage increased prepackaged shrinkage increased.

Firmness of the beef was not significantly related to color stability when measured either subjectively or objectively. Soft lean pork cuts received a lower subjective color score than the firm cuts. However, firmness of the pork lean was not significantly associated with the spectrophotometric method of measuring color. Color stability decreased as duration and temperature of storage increased.

Firm lean pork consistently received a slightly higher taste panel score than the soft lean cuts. There was a slight preference of the soft lean beef over the firm beef.

The pH values were higher with the firm lean pork muscles as compared to the soft lean muscles. No significant differences were found between the beef firmness groups for pH.

The per cent moisture loss (drip) of pork decreased as pH of the pork lean increased and as temperature and length of storage increased. The per cent drip with the beef samples increased as temperature and duration of storage increased. The pH of the beef lean was not significantly associated with the per cent moisture loss (drip). The amount of water insoluble residue for both species varied inversely with the per cent drip.

The results of this investigation indicate that firm lean meat will exhibit superior shelf life characteristics as compared to the softer lean cuts. The softer lean cuts appear to exhibit similar shelf life characteristics if stored at 34° F. (1.1° C.) for two days.

Microfilm \$2.75; Xerox \$8.40. 185 pages.

DETERIORATIVE CHANGES IN FROZEN SHRIMP AND THEIR INHIBITION

(L. C. Card No. Mic 59-2976)

Marian B. Faulkner Chastain, Ph.D.
The Florida State University, 1955

Changes in frozen cooked shrimp were shown to be of two types: (a) oxidative, resulting in color, flavor, and odor loss; (b) texture changes attributed to protein denaturation. Shrimp received various treatments expected to inhibit either or both types of deterioration.

The red color of cooked shrimp is due to a carotenoid pigment, astaxanthin. The fading of the pigment which

takes place during freezer storage was found to be related to flavor and odor changes. Color loss is apparently an oxidative change analogous to the bleaching of beta-carotene in the presence of oxidized fats. Astaxanthin and probably smaller amounts of other pigments were extracted by blending ground shrimp with acetone and sodium sulfate. Spectrophotometric analysis of extracts showed an absorption peak at 473-477 mμ. On this basis a colorimetric method using the Evelyn photoelectric colorimeter with a 470 mμ filter was adopted for measurement of fading. The values obtained served as a quantitative measurement of the degree of oxidation which had occurred after various storage times.

All shrimp were tested organoleptically and scored by judges for color, flavor, odor, and texture on a ten-point scale. In the second part of the study, the colorimetric method for evaluation of quality was also used. The latter method proved to be more sensitive to early signs of deterioration than the organoleptic method.

General deterioration was greater in precooked frozen shrimp prepared from previously frozen and thawed material stored at -4° C. before and after processing than in those prepared from fresh material and stored at -18° C. The former showed changes in color, flavor, odor after three months and texture changes after six months while the latter showed little deterioration up to ten months. Deterioration increased between the tenth and twelfth month of storage.

Various anti-oxidants known to be effective in other foods were tested for their effect on shrimp. Oxidative changes were inhibited by the use of ascorbic acid, butylated hydroxyanisole, or liquid smoke flavoring. Ascorbic acid and liquid smoke acted synergistically in inhibiting oxidative changes.

There was some evidence of texture impairment by ascorbic acid. This was probably a pH effect and could be overcome by the use of ascorbate rather than the acid. Texture was impaired by sodium chloride. In some experiments, texture was improved by sodium tripolyphosphate while in others the agent had no effect.

Precooked frozen shrimp were not as acceptable after twelve months storage as were shrimp which were cooked after freezer storage. The increased convenience of the precooked product may overcome the advantage of a slightly higher quality in the raw frozen shrimp.

"Smoked" shrimp prepared by the addition of liquid smoke flavoring to the cooking water proved to be an acceptable product.

Microfilm \$2.75; Xerox \$3.00. 43 pages.

HEAT INDUCED HEME CATALYZED LIPID OXIDATION IN ANIMAL TISSUES

(L. C. Card No. Mic 60-3317)

Basil George Tarladgis, Ph.D.
The Florida State University, 1960

A modified and improved distillation method for the quantitative determination of malonaldehyde in rancid foods has been described. The method is based on the reaction of malonaldehyde with 2-thiobarbituric acid. The use of this method allows quantitative comparisons of results on

fat oxidation in various foods performed by different workers. This method made possible the quantitative measurement of malonaldehyde produced during the oxidation of pure unsaturated fatty acids under controlled conditions and its correlation to their off odor. It was found that malonaldehyde does not accumulate as a stable end product of fat oxidation, but follows closely the oxygen uptake of unsaturated fatty acids, reaching a peak at the same time that oxygen uptake begins declining.

Statistical evaluation of taste panel results and 2-thio-barbituric acid tests for tissue rancidity showed that the rancid odor is responsible for the off odor of frozen cooked meats and is a substantial component of the off odor in irradiated cooked meats. Lipid oxidation was eliminated by the use of suitable antioxidants, bringing about a significant improvement in odor ratings.

Assays performed on frozen control and irradiated meats during storage periods, showed that oxidation of tissue lipids increased in the frozen samples, but decreased in the irradiated ones. This is attributed to differences in the heme pigments. The ferrihemichromogen of the cooked meats is active as a catalyst, while the ferrohemochromogen of the irradiated meats is inactive.

The catalytic effect of oxyhemoglobin and methemoglobin on oxidation of unsaturated fatty acids has been measured. Evidence from these experiments and from

experiments on meat leads to the conclusion that the ferric heme compounds initiate fat oxidation, while the ferrous heme compounds are inactive in absence of preformed peroxides. A comprehensive theory of the catalytic activity of heme compounds for lipid oxidation in animal tissues has been presented, based on experimental and theoretical evidence.

According to this theory, the catalytic activity of the heme compounds depends on their magnetic properties. Thus, paramagnetic heme compounds initiate fat oxidation directly, while diamagnetic ones do so only indirectly, by hydroperoxide decomposition. The process takes place through an exchange of electrons between the iron of the hemes and the lipids or hydroperoxides; i.e. electrons are abstracted from lipid chains by ferric hemes and donated to lipid peroxides by the ferrous hemes. Donation or acceptance of electrons does not take place through abnormal intermediates or intermediates of an enzyme-substrate type, which are difficult to visualize in denatured tissue, but through oriented water molecule bridges or diffusion through the coordination ligands. Eventual ring destruction and dissociation of the iron from the coordination complex follows both electrophillic and nucleophillic attacks on the π electron cloud of the porphyrin molecule, at the places of the higher and lower electron densities, respectively.

Microfilm \$2.75; Xerox \$4.00. 71 pages.

GEOGRAPHY

GEOGRAPHIC FACTORS INFLUENCING THE MANUFACTURAL INDUSTRIES OF UPPER EAST TENNESSEE

(L. C. Card No. Mic 60-4670)

Terry Elmer Epperson, Jr., Ph.D.
The University of Tennessee, 1960

Major Professor: Lillian W. Stimson

This study presents an inventory and analysis of the geographic and socio-economic factors influencing the location and development of manufactural industries in Upper East Tennessee. A combination of many determinants has gradually changed the basic economic structure of the area from that of a modified form of subsistence agriculture to one of manufactural importance within the state and in the nation.

The area under study consists of Carter, Johnson, Unicoi, Washington, and Sullivan counties. Three of the counties, Carter, Johnson, and Unicoi, have a predominance of mountainous land; the other two, Washington and Sullivan, present contrasting aspects of valley and ridge terrain. Natural features thus divide this contiguous area into two heterogeneous physical areas which are almost equal in size. This areal equality makes it possible to relate the various influencing effects of the physical to those of the cultural environment. The common knowledge that people and their activities tend to concentrate at lower elevations is exemplified here. In the same area there are noticeable

effects of what time and cultural change can do in overcoming the difficulties presented by the physical environment.

The study presents first the physical setting, then as follows in order: water resources and power development, transportation, transmission and communication, population trends, manufactural development to 1947, geographic aspects of manufacturing from 1948 to the present, urbanization, and prospects.

Special attention has been placed on water resources and power development because of the over-all importance of water to industrialization and urbanization and to the local development of this resource by the Tennessee Valley Authority. The availability of surplus water which could be used by expanding industry tends to add importance to the physical resources.

Considerable attention has been given to the systems of transportation, transmission, and communication with relationships drawn between these and the physiography, local diverse economic development, and expanding national markets. Emphasis has been placed on the adjustment of land-based routes of communication to the local landforms and also to the resultant rural and urban settlement patterns.

Population growth has had a decided effect on the over-all economy; thus early history and population statistics are basic to an understanding of the economic changes and settlement trends. The study has attempted to show these in relation to industrial growth.

The Upper East Tennessee area has undergone various

phases of industrialization and urbanization. Early manufacturing development was dependent on local extractive industries whereas today many of the industries such as the chemical and electronic establishments are based on technology and the importation of raw materials. Numerous physical and cultural factors have influenced both the location of individual plant sites and the areas of densest settlement, and this study attempts to show the physical and cultural relationships which developed as manufacturing evolved.

The latter part of the study represents an endeavor to bring into focus the resulting factors of the geographic and socio-economic relationships which have brought about the present trends and patterns in area growth. An over-all picture of urbanization is presented with special attention given to growth between 1902 and 1959. The study concludes with an examination of possible future trends in an already rapidly developing area--Upper East Tennessee.

Microfilm \$3.45; Xerox \$12.15. 266 pages.

THE CHARACTERISTICS, PROBLEMS AND POTENTIAL OF MANUFACTURING IN THE UTICA AREA

(L. C. Card No. Mic 61-515)

Sidley Kerr Macfarlane, Ph.D.
Syracuse University, 1960

The purpose of this study is to analyze the characteristics, problems and potential of manufacturing in the Utica area. The region examined includes Utica and its contiguous urban communities, since it was in these towns especially that the textile industry flourished from 1850 till 1920. By 1958 industrial changes, increasing in tempo after World War II, altered the manufacturing composition from textiles to one dominated by the metals industries.

The analysis is carried out by a survey of industrial growth to determine reasons for the location of the early firms; an evaluation of the physical base on which the local industrial structure is erected; an inventory of the current manufacturing symbiosis; and finally, an examination of recent internal and external industrial movement and the present dynamic manufacturing industries.

Findings indicate that the local textile industry was successful in the early days because the industry throughout the country was dynamic. Utica's plants, besides being new and equipped with the latest machinery, were located on the western edge of a westward migration of people and industry. Thus for many years textiles were favorably located here.

Today industrial locational influences have forced textiles to move south and durable goods industries have replaced them. The new industries are branches of national corporations which means that policy making has essentially passed from local control. The size of the new plants in most instances is larger than the textile firms they replaced, and the new construction has taken place in the fringe zone of the urban area.

One of the area's industrial liabilities is the great number of old and multi-storied plants in which it is almost impossible to carry on efficient manufacturing operations. Another is the high percentage of source materials and

finished products which are bought and sold outside the region and state. To offset these disadvantages the area has assets in its location on the Mohawk corridor with its highly developed transportation facilities; in the abundant land suitable for industrial development; in an adequate utility network; and in its position in the center of the industrial northeast part of the country. The new large industries which have entered the area during the last decade are among the most dynamic growth industries in the country.

With slight modifications the pattern of recent industrial development is essentially repeating that of Utica's early expansion. First it was textiles in their growth period; currently, it is durable goods.

Most of the data for this study were obtained through personal interview questionnaires and field observation.

Microfilm \$3.15; Xerox \$11.05. 242 pages.

THE INDUSTRIAL DEVELOPMENT OF THE BASIN OF VALENCIA, VENEZUELA.

(L. C. Card No. Mic 61-517)

Clarence Wilbert Minkel, Ph.D.
Syracuse University, 1960

Supervisor: Preston E. James

The Basin of Valencia, in northcentral Venezuela, is experiencing a remarkable industrial growth. Among more than 700 manufacturing units within the area, 80 per cent have been established within only the past twelve years. Moreover, an overwhelming majority of the manufacturers anticipate a continued expansion of facilities and production.

This study constitutes a comprehensive description and analysis of the process of industrialization as it is taking place within the Basin. The historical background for industrialization is investigated, as are the causes of the rapid industrial growth since 1948. The nature and extent of existing industry, including employment data by types of industry and by communities, are presented on the basis of detailed land-use surveys and personal interviews at each of the Basin's industrial establishments. The impact of industry upon both the rural and urban characteristics of the study area is likewise investigated.

Throughout the study particular attention is given to the trends, plans, problems and potential of the Basin of Valencia, as considered within the larger framework of the Venezuelan nation as a whole.

The principal conclusions of the study are as follows:

1. Within Venezuela, the Basin of Valencia offers unexcelled attractions to manufacturing and processing enterprises. It is therefore experiencing a rapid development which may result in its becoming the nation's principal industrial area.
2. Until recently, nearly all of the industrial development in the Basin of Valencia has been concentrated in Valencia and Maracay, the principal urban centers. The present trend is toward a dispersal of industrial growth within the Basin, revitalizing many of its smaller communities.
3. The progress of industrial development in the Basin

of Valencia has been intimately interwoven with the development of transportation, communication, and public services. The future significance of the Basin of Valencia as an industrial center will depend to a large extent upon the outcome of projects already begun for the extension of these facilities and upon the improvement of services.

4. The type of agriculture practiced in the Basin of Valencia has been subject to many changes since the area was first settled by Europeans. Further significant changes are taking place due to the impact of industrialization upon land values, intensity of land use, rural labor supply, and the manner of processing agricultural commodities.

5. The much-desired goal of economic independence for Venezuela is unlikely to be achieved through the process of industrialization. The opposite, greater dependence upon the outside world, is more likely to be the result. The gain through industrialization must rather be measured in such terms as the increase of employment opportunities, the rise in standard of living, the development of technical skills, and perhaps eventually in the development of a middle class in the nation's social structure.

6. There is in industrialization much of the potential for re-making a country which has been, until recently, politically and economically one of the most backward in South America. The contribution which Venezuela's newly-acquired industry will make will depend largely upon the attitudes of the Venezuelan people toward education, immigration, government, and toward industry itself and upon effective planning for the future.

Microfilm \$3.45; Xerox \$11.95. 265 pages.

DISTRIBUTION OF SALT AND SILT IN IRAQ AGRICULTURE

(L. C. Card No. Mic 61-519)

Hassan Taha Najim, Ph.D.
Syracuse University, 1960

This study deals with the problems of salt and silt in Iraq agriculture. The accumulations of evaporation salts in the irrigated fields and of silt in the canals have been the major sources which have caused serious trouble to cultivation. Salt accumulation in the soil hampers the growth of crops and eliminates many sensitive varieties, while silt accumulation in the canals reduces their conveyance capacity of water. Either case may cause the abandonment of the irrigated area. Not enough attention has been given to their control or to the reduction of their damage. This study examines the location and distribution of their occurrence, and evaluates the current planning in order to develop agriculture in terms of these conditions.

With the exception of the present importance of the oil industry, agriculture plays a large role in the national economy. Thus, the extent of harm caused by salt and silt in Iraq is very great. The occurrence of these problems has taken place since early days of irrigation in the country. Careless irrigation and shifting agriculture over the many centuries of occupancy have given them a wide scale of distribution over most of the southern Mesopotamian plain, whether on areas presently under cultivation or not.

The physical properties of this plain, such as the flat surface, gentle slope, tight soil, aridity of climate and high

evapotranspiration, have encouraged the development of the two problems. Variation in the distribution of these features, no matter how slight, has caused a difference in the intensity of occurrence of salt and silt accumulation. Thus, salinity increases in extensiveness and intensity from north to south. It also becomes more severe as one moves away from river levees toward the basin land of the rivers. Silt accumulation in the canals, on the other hand, increases as the canal has less gradient and the slope of land becomes more gentle. At present, the problem of silt accumulation is encountered north of the swamp area, because of the fact that the swamps offer an important desilting function. Despite the importance of irrigation planning to the future of agriculture in Iraq, no such task should be taken without facing the facts concerning the occurrence of the problems in question. It is very likely that as a result of present development projects in the field of irrigation, agriculture will suffer more from them unless drainage and leaching as measures against salinity, and desilting as a measure against canal silting, are taken in the meantime.

Modern irrigation planning in Iraq, as evidenced by the five-year plans of the former Development Board, attempts to increase agricultural production by adding new irrigated areas. It should be remembered that the increase of agricultural production can be achieved not only by adding new areas, which proved to have the same problems of salt and silt, but also by improving the properties of the currently irrigated areas and the arrest of silt accumulation in the canals. This study emphasizes the fact that the latter program should be given a priority in the current planning for agricultural development. The existence of the main irrigation facilities, transportation lines and the majority of the rural population on the areas presently under irrigation offer other justifications to the case.

Microfilm \$3.80; Xerox \$13.30. 294 pages.

AN ANALYSIS OF RECENT INDUSTRIALIZATION IN NORTHEASTERN GEORGIA

(L. C. Card No. Mic 60-6569)

Raymond Mervyn Northam, Ph.D.
Northwestern University, 1960

Supervisor: Clarence F. Jones

Industrialization in Georgia has been most pronounced in recent years in the period 1952-1957, with two sections of the state experiencing the greatest growth. The Atlanta Standard Metropolitan Area and the fourteen county area herein designated as northeastern Georgia have each accounted for approximately 18 per cent of the new industrial employees during the above period. In a relative measurement, however, northeastern Georgia has had a much greater increase, and for this reason deserves special attention, since the impact of new industries upon the local economy has been greater.

Of the ninety-four newly located plants in northeastern Georgia, twenty-six are known to be relocated plants or extraregional branch plants. Nearly all of these have origins in the American Manufacturing Region, especially the population centers of New York, Philadelphia, and

Chicago. These and other new plants are distributed within the region in general accordance with population distribution, with larger urban centers of Athens and Gainesville having experienced the greatest increases in new plants and new industrial employees.

The types of new plants most common to this area are those manufacturing apparel, poultry feed, metal products, lumber, and food products. Of these types, the plants making metal products have a somewhat exotic nature in that they have not previously been established in noticeable numbers. Most of the new plants are small in terms of employees, with the modal value being 1-24 persons. Most of the new concerns are located in rectangular buildings which are either of small or very small size. The greatest portion of the buildings are one story in height and are constructed of brick, concrete, or sheet metal. The largest share of the new plants is located on or very near to arterial highways, which allows them the access to truck transportation which they need. Less than one-third, however, are located on rail lines, indicating a low reliance upon this form of transportation.

It has been determined that fourteen determinants of location have led to the location of new manufacturing concerns in northeastern Georgia. Certain of these have been significant in determining the regional location of the plants, while others have been important in determining the site of the new plants. Further, not all determinants have been equally important in all cases, and even where a given factor has applied, it may only have been of minor importance.

The four principal factors of location, as determined by a weighting formula, are labor supply, transportation, markets, and raw material availability. These four factors have all been significant in determining the regional location of the plants, more than in site selection. There are wide variances between industry classes as to the importance of the above factors, such as is illustrated by the great importance of labor to apparel plants but the lack of importance of the same factor to concrete products plants, feed mills, and lumber mills.

Of the remaining determinants, building availability is the most important, followed in order by individual precedent, industry precedent, local cooperation, personal amenities, water supply, proximity to Atlanta, land availability, housing, and public services.

With a continuance of agricultural deemphasis, there should be made available in the region an increasing number of white, unskilled males of the type most desired by newly located firms. This should lead to continued development of industries with large demands for unskilled yet highly productive workers. The four principal locational determinants should remain important in the future and the actions of the minor locational determinants will affect smaller, locally developed industries the same as they have in the recent past. The larger urban centers of northeastern Georgia are in the best positions to receive new plants with origins outside the region, regardless of whether they employ white males, white females, or colored employees.

Microfilm \$3.50; Xerox \$12.40. 271 pages.

GEOLOGY

THE PALEONTOLOGY AND STRATIGRAPHY OF THE MISSISSIPPIAN SYSTEM OF SOUTHWESTERN NEW MEXICO AND SOUTHEASTERN ARIZONA

(L. C. Card No. Mic 60-3286)

Augustus K. Armstrong, Ph.D.
University of Cincinnati, 1960

The Mississippian system in western Cochise County, Arizona and in Luna, Hidalgo and Grant Counties, New Mexico, is described. The primary concern of this study is the Osage through Meramec Escabrosa limestone, its stratigraphy, paleoecology and biologic contents. The Escabrosa limestone in this report is regarded as a group and has been divided into two formations. These are in ascending order the Keating formation (Fern Glen to Burlington [Osage] to St. Louis [Meramec]). The Escabrosa group has a minimum thickness of 650 feet in the Peloncillo Mountains and a maximum thickness of 1000 feet in the Big Hatchet Mountains of New Mexico. In the area of this report it is primarily an encrinite with minor amounts of microcrystalline limestone. These sediments represent almost continuous deposition through all of Osage and Meramec time. The strata were deposited over a slowly sinking shelf area in shallow normal marine waters.

The corals, brachiopods, blastoids, and endothyrids collected from the Escabrosa group are described and illustrated. The following new species were found: *Chonetes klondika*, *Cleiothyridina everharti*, *Unispirifer balki*, *Amplexizaphrentis sonoraensis*, *Amplexizaphrentis northropi*, *Kakwiphyllum sutherlandi*, *Lithostrotion lochmani*, *Syringopora robusta* and *Michelinia leptosphragma*.

The late Meramec to middle Chester Paradise formation is delineated and part of its brachiopod fauna is described. The Paradise formation is an alternating series of medium-bedded limestones and shales with a maximum thickness of 220 feet in the Big Hatchet Mountains of New Mexico. It thins rapidly to the north, and to the west and is only some 80 feet thick in the eastern Chiricahua Mountains of Arizona. The Helms formation of Chester age in the Franklin Mountains is discussed and its coral fauna described, which contains the new coral species *Koninickiphyllum elpasoensis*.

Microfilm \$4.70; Xerox \$16.65. 367 pages.

PETROLOGY AND STRUCTURE
OF THE GABBRO IN THE
JONESPORT-MILBRIDGE AREA, MAINE.

(L. C. Card No. Mic 61-85)

Marion Eugene Bickford, Jr., Ph.D.
University of Illinois, 1960

Bedrock in the Jonesport-Milbridge area, in the southeastern coastal region of Maine, consists of: the schist of Columbia Falls (greenschist, greenstone, and conglomerate), the Bar Harbor series (quartzo-feldspathic sedimentary rocks and tuff), a complex of gabbroic rocks, granophyre, and biotite granite. The Bar Harbor series is unmetamorphosed, and younger than the schist of Columbia Falls. The gabbro complex encloses inclusions of the Bar Harbor series, but is intruded by the granophyre and the biotite granite.

The gabbro complex consists of olivine gabbro, gabbro, quartz-gabbro, and quartz-ferrogabbro. Composition of plagioclase, olivine, hypersthene, and augite was determined by optical methods. Modes were determined for a number of specimens of each type.

The gabbro complex displays four types of stratiform features: rhythmic layering; "turbulence layering"; igneous lamination; and quartz-diorite layers. These features and their structural attitude indicate that the complex is a stratified body, folded into a broad, eastward plunging syncline. Abundant exposures of sheared and brecciated rocks, and outcropping faults, indicates that faulting has been important.

If the gabbro types are arranged in a vertical column as follows: olivine gabbro (lowest); gabbro, quartz-gabbro, and quartz-ferrogabbro (highest); the mineralogical variation upwards is very similar to that noted in many stratified, basic bodies. Olivine occurs in the lowest rocks, which are quartz-free, with calcic plagioclase. In higher rocks, olivine disappears, quartz appears, and plagioclase becomes more sodic. In the highest rocks of the series, plagioclase is quite sodic, ferromagnesian minerals are iron-rich, and fayalitic olivine coexists with minor quartz. Compositional variation of augite and hypersthene is very slight in the lower three gabbro types.

Field and petrologic data were used to locate numerous faults, to determine their relative displacements, and to construct structure sections. Based upon the structural interpretation given, the minimum thickness of the gabbro complex is calculated to be approximately 15,000 feet. It is recognized that the data do not permit accurate calculation, but the order of magnitude is believed to be correct.

Rhythmic layering is believed to result from gravitational settling of mafics and plagioclase at a differential rate from magmatic currents. Both mechanical and chemical mechanisms may cause the observed periodicity in rhythmic layering. "Turbulence layering" is developed in rocks with pronounced ophitic texture, and is believed to be related to periods of turbulent magmatic flow, causing disorientation of plagioclase and greater interstitial space to be occupied by mafic minerals.

The very slight compositional variation of augite and hypersthene in the olivine gabbro, the gabbro, and the quartz-ferrogabbro creates a petrologic problem, for which the writer presently has no answer.

Microfilm \$2.75; Xerox \$5.40. 107 pages.

MISSISSIPPIAN SMALLER FORAMINIFERA
OF SOUTHERN INDIANA, KENTUCKY,
NORTHERN TENNESSEE, AND
SOUTH-CENTRAL OHIO.

(L. C. Card No. Mic 60-3290)

James Elvin Conkin, Ph.D.
University of Cincinnati, 1960

This paper is the first attempt at regional investigation of the occurrence in time and distribution in space of faunas of smaller Foraminifera in any Paleozoic system in North America. The investigation has been directed upon the Mississippian system, particularly aimed at examination of the Lower Mississippian sequence which I have long known to contain rather well developed foraminiferal assemblages.

Geologic sections were measured and collections made from 89 localities in southern Indiana, Kentucky, northern Tennessee, and south-central Ohio. The shale beds were found to contain more smaller Foraminifera than the limestones, thus emphasis was placed upon these fossiliferous shales.

During this study, Mississippian smaller Foraminifera were recognized for the first time from Ohio and Tennessee. Previous to this study, only one Mississippian formation in Kentucky was known to contain smaller Foraminifera (Conkin, 1954); during this study most of the Mississippian formations were found to contain smaller Foraminifera in greater or lesser amounts. This paper describes these Mississippian faunas and attempts to recognize usefulness of certain genera, species, and faunal assemblages in stratigraphy and correlation.

The Foraminifera herein described are allotted to 12 families, one of which, the Miliolidae, is new to the Mississippian system; to 18 genera, seven of which are new to the Mississippian system: *Agathammina*, *Climacamina*, *Crithionia*, *Proteonina*, *Stacheia*, *Thuramminoides*, and *Trochammina*; and to 38 species, 18 of which are described as new species. One genus, *Thuramminoides*, is removed from the family Saccamminidae and placed in the family Astrorhizidae. A proposal is introduced to formalize the emendation of *Hyperammina* made by Conkin in 1954. One specific revision is included: *Thuramminoides sphaeroidalis* Plummer. One genus, *Lugtonia* Cummings, 1955 and one species, *Thuramminoides teichertii* (Parr), (Crespin, 1958) are placed in synonymy.

A practical scheme of classification of wall structure of Mississippian Foraminifera, based on and modified after the classification of H. B. Brady, 1876, H. J. Plummer, 1930, and R. H. Cummings, 1955 is presented here. The Mississippian Foraminifera are, by this introduced classification, divided into four large groups:

1) Arenaceous.

A) calcareous - extraneous grains in calcareous and/or ferruginous cement.

B) siliceous - extraneous grains in siliceous cement.

2) Granular calcareous - equidimensional grains of calcite embedded in crystalline calcite.

A) calcite granules secreted by the protoplasm?, embedded in crystalline calcite.

B) calcite granules derived from a supersaturated limy sea bottom by selection of extraneous calcareous material by the protoplasm?

3) Compound wall - inner layer of fibrous calcite; outer wall layer of microgranular layer of calcite, or altered from calcite.

4) Amorphous calcite, or imperforate calcite.

Paleozoic smaller Foraminifera are rather conservative in their evolution; nevertheless, certain genera are found to possess enough biologic change to permit their use in division of the Mississippian sequence on a series level, and in some instances on smaller intervals.

The most important genus in stratigraphic division of the Lower Mississippian of the studied area is *Hyperammina*. Evidence for the evolution of one species, *H. kentuckyensis* from another, *H. rockfordensis* is presented, and the time of mutation is rather closely determined to be during Upper Coral Ridge time (Lower Osagian).

Division of the Mississippian system in the studied area into series characterized by certain species, genera, or faunal assemblages of Foraminifera follows:

Chesterian - zone of *Millerella*; endothyrids, *Climacamina*, *Earlandia*, and *Hemigordius*.

Meramecian - zone of endothyrids; *Earlandia*.

Osagian - zone of *Hyperammina kentuckyensis* and large *Thuramminoides sphaeroidalis*; this zone is divided into six subzones.

Kinderhookian - zone of abundant *Involutina* with rare occurrence of *Thuramminoides sphaeroidalis*.

Attempts were made to interpret the paleoecology of the individual species and to give information concerning the mode of deposition of the sediments in which the Foraminifera occur.

Microfilm \$5.75; Xerox \$20.50. 452 pages.

GEOLOGY OF THE GILSON MOUNTAINS AND VICINITY, JUAB COUNTY, UTAH.

(L. C. Card No. Mic 60-6225)

John Kendall Costain, Ph.D.
University of Utah, 1960

Chairman: Francis W. Christiansen

The area mapped comprises approximately 185 square miles in west central Utah and includes the Gilson Mountains, Champlin Hills, Jericho Ridge, and the southern part of the East Tintic Mountains. The area lies near the boundary between the High Plateaus of Utah and the Basin and Range Province.

Precambrian rocks correlated with the Big Cottonwood Series and the Mutual Formation of the Central Wasatch Mountains are exposed north and south of the Sevier River in Leamington Canyon. Rocks of all the Paleozoic systems are represented within the area mapped and an aggregate thickness of approximately 24,000 feet of Paleozoic strata

divisible into eighteen formations is exposed. The rocks are predominantly marine carbonates with quartzose sandstones present in the Upper Devonian, Upper Mississippian, and Pennsylvanian. Upper(?) Cretaceous conglomerates tentatively correlated with the Indianola Conglomerate of the Gunnison Plateau crop out in the eastern part of Leamington Canyon. Pliocene(?) lake sediments correlative with the Salt Lake Group underlie the pediment surface north and northwest of the Gilson Mountains. Pleistocene sediments of Lake Bonneville are exposed in and near Leamington Canyon.

Quartz latite extrusives in the eastern and southeastern parts of the area mapped are correlated with the latite volcanic series of Medial Eocene age in the East Tintic Mountains.

Paleozoic sedimentary rocks record only epeirogenic uplifts resulting in the development of disconformities or low angular unconformities. Much of the direct evidence bearing on Late Mesozoic history of the area has been removed by erosion, but sufficient facts are available to indicate a sequence of events which not only establishes the structural evolution of the Gilson Mountains, but also suggests that Early Laramide structures in the northern part of the Canyon Range formed in response to diastrophic events in the area of the Gilson Mountains.

The Gilson Mountains and adjacent areas to the west and northwest are postulated to have been located on the easternmost flank of the Sevier Arch, a Late Mesozoic positive area in western Utah. The tectonic history of the area mapped and of the Canyon Range to the south is closely related to the development of this Arch.

Two reverse faults with stratigraphic displacement of approximately 20,000 feet and 16,000 feet occur at the northern and southern margins of the Gilson Mountains. The northern boundary of the Canyon Range thrust sheet is exposed at the southern margin of the Gilson Mountains.

The major structural features in the Gilson Mountains are a result of four major stages of deformation. Disturbances of lesser magnitude probably influenced the area but are of minor significance. The first major diastrophic event probably occurred in Early Cretaceous time and involved large scale uplift culminating in stratigraphic displacements of approximately 20,000 feet. The second major diastrophic event closely followed the first in Early Cretaceous time and resulted in the emplacement of the Canyon Range thrust sheet. The third major diastrophic event is correlated with the Mid-Cretaceous Cedar Hills orogeny which resulted in renewed uplift of the Sevier Arch and deposition of the Indianola Conglomerate. The fourth major diastrophic event took place in Early Laramide time resulting in renewed movement along the Canyon Range thrust and thrusting of the Gilson Mountains to the East. Basin and Range block faulting occurred in Medial(?) to Late Tertiary time.

The Sevier River is postulated to have formerly flowed north through Juab Valley into the area of Utah Lake during Late Tertiary time, its present course through Leamington Canyon being a result of stream piracy.

Microfilm \$2.75; Xerox \$8.20. 178 pages.

PHYSICAL, CHEMICAL AND THERMAL
PROPERTIES OF SELECTED
VITRINITIC SUBSTANCES

(L. C. Card No. Mic 61-32)

Russell Richardson Dutcher, Ph.D.
The Pennsylvania State University, 1960

Fourteen samples of vitrinitic materials selected from megascopically recognizable vitrain bands of coal have been studied by the following techniques, 1) micro-chemistry, 2) thin section examination, 3) reflected light examination, 4) reflectance, 5) electron microscopy, 6) microhardness, and 7) thermal studies in a microscope heating stage. The samples selected were from coals ranging in rank from subbituminous C to anthracite. The geologic ages of the specimens range from Pennsylvanian to Tertiary. Geographically, the specimens were obtained from Alaska, Kentucky, Pennsylvania, Nova Scotia, Utah, West Virginia, and Wyoming. Three specimens of extant woods were subjected to high-pressure and high-temperature studies in attempt to investigate the process of vitrification.

Twelve of the fourteen macerals studied fall into the classificatory groups proposed by Spackman, (1958); one xylinoïd, nine vitrinoïds, and two anthrinoïds. Establishment of a fourth group within the vitrinite suite is justified and the term meta-vitrinoïd is proposed for this.

Seven evolutionary groups of macerals are established within the fourteen vitrinitic samples under study. These groups may exist together within any one coal. The concept of rank as classically understood does not apply to coal on a normal microscopic basis. It is generally valid for whole coal (not subdivided petrographically to any degree) but not for maceral suites. Greater validity is found for the rank concept within the detailed evolutionary groups as established. Microfilm \$2.75; Xerox \$9.25. 201 pages.

ELASTIC WAVE STUDIES IN
THE ARCTIC OCEAN

(L. C. Card No. Mic 60-6736)

Kenneth Leland Hunkins, Ph.D.
Stanford University, 1960

I Seismic studies of sea ice.

During the International Geophysical Year, a scientific research station, Drifting Station Alpha, was maintained on the floating ice of the central Arctic Ocean. Wave propagation in sea ice was one of the studies made at this base. Throughout the year velocities of longitudinal and transverse waves in ice were measured. A marked seasonal change in velocity was found and attributed to temperature changes. From the velocity and density determinations, the elastic constants of sea ice can be calculated for various times of the year.

Flexural wave dispersion was investigated under different conditions of range, charge size and ice conditions. Experimental results in general agree with theory. Thickness as determined from the dispersion of flexural waves is characteristically a little lower than that found by actual

drilling. Air coupled flexural waves give similar results for ice thickness.

Several effects of leads on wave propagation were noted. The longitudinal waves and flexural waves suffer extreme attenuation across leads. Lateral reflection of flexural waves from leads was observed. The effect of leads in shortening the length of the air-coupled wave train was also noted.

Finally, very long waves in floating ice were studied theoretically and experimentally. The dispersion curve for the complete long wave spectrum of water gravity waves and flexural waves was calculated using an IBM 650 computer. A flat group velocity minimum occurs with a period range from 10 to 50 seconds. Waves with periods in this vicinity were observed with a Frost gravity meter employed as a long period seismometer. From the observed wave motion it appears that much of the wave energy due to natural causes in the Arctic Ocean may be concentrated in the area of this calculated velocity minimum.

II Seismic studies of the Arctic Ocean floor.

Seismic reflection and refraction techniques were employed on Drifting Station Alpha to study the bottom and sub-bottom structure of the Arctic Ocean.

About 600 sonic soundings of the ocean were made. An array of detectors permitted determination of the dip and strike as well as depth of the ocean floor. Most of the drift took place over a feature of rugged topography, the Alpha Rise. Dips ranged from 0° to 22°. Depths varied widely but were in the vicinity of 2,000 m. This submarine feature is more prominent than previously believed and is one of the major topographic highs of the Arctic Ocean.

Several short refraction stations were made while the station drifted over the Alpha Rise. The deepest layer measured has a velocity of 6.4 km/sec at a depth of 4.5 km. The sections resemble those obtained in the Atlantic Ocean. The refraction data together with the topographic information suggests that the Arctic is a normal ocean basin, similar in structure to the Atlantic.

Microfilm \$2.75; Xerox \$6.40. 132 pages.

ANALYSIS OF THE VISCOELASTIC
PROPERTIES OF SOME RHEOLOGICAL MODELS
AS APPLIED TO EARTH MATERIALS

(L. C. Card No. Mic 60-6766)

Tsvi Meidav, Ph.D.
Washington University, 1960

Chairman: LeRoy Scharon

This study is an attempt to find a phenomenological model which will behave in a manner similar to that of common earth materials in regard to the dependence of attenuation and phase velocity on frequency.

An analysis of two previous rheological models, Maxwell's and Kelvin-Voigt's, is presented, indicating that these models are too simple to conform phenomenologically to the behavior of rocks. It is shown that a linear combination of the above two models, known as the standard linear

solid, comes closer to giving an adequate description of the behavior of some earth materials.

A method of determining the viscoelastic constants of a solid is presented provided that its attenuation and dispersion curves are known. The viscoelastic constants (relaxation times and/or viscosity coefficients) of the solid are determined by superimposing the experimental curves on master curves, and reading the constants off the theoretical curves.

An analysis of two sets of published experimental data (McDonal et al, 1958; Bruckshaw and Mahanta, 1954) is presented, indicating that the present model is capable of accounting for at least some attenuation and dispersion phenomena. Microfilm \$2.75; Xerox \$5.00. 100 pages.

GEOLOGY OF THE PROMONTORY RANGE, BOX ELDER COUNTY, UTAH.

(L. C. Card No. Mic 60-6242)

Richard Hubbell Olson, Ph.D.
University of Utah, 1960

Chairman: William Lee Stokes

The Promontory Range, Box Elder County, Utah, is the first mountain range west of the north-central Wasatch Mountains.

An almost complete stratigraphic record from early Late Precambrian to Early Permian is present. No Mesozoic or Tertiary strata have been noted, but the Late Pleistocene is very well represented by the deposits of Lake Bonneville.

Systemic lithologies and thicknesses are as follows: Precambrian (phyllite, shale, mafic extrusives, quartzite) 7,443⁺ feet; Cambrian (quartzite, calcareous siltstone, limestone, dolomite) 10,762⁺ feet; Ordovician (limestone, shale, quartzite, dolomite) 2,992⁺ feet; Silurian (dolomite) 757 feet; Devonian (predominantly dolomite) 1,576⁺ feet; Mississippian (limestone, calcareous orthoquartzite, sandstone, shale) 2,619⁺ feet; Mississippian-Pennsylvanian (quartzite, shale) 1,088⁺ feet; Pennsylvanian-Permian (limestone, calcareous orthoquartzite, shale) 3,213⁺ feet; and Pleistocene (gravel, sand, silt, clay) 1,000⁺ feet. The Precambrian and Pleistocene sequences are undifferentiated; 24 Paleozoic formations are recognized but no new formational names are introduced.

Three major unconformities have been recognized: (1) at the base of the Upper Ordovician, (2) at the base of the Lower Mississippian, and (3) at the base of the Pleistocene.

With the exception of a sill in the Middle Cambrian sequence, igneous rocks are confined to the Precambrian and are largely extrusive.

Metamorphism of higher grade than that of the greenschist facies has not been recognized. The Precambrian stratigraphic sequence, carbonate strata in the lower plate of an overthrust fault, and argillaceous Mississippian-Pennsylvanian strata in the northern portion of the range have been subjected to pervasive low-grade metamorphism; but on the whole metamorphism is relatively unimportant in the rocks of the Promontory Range.

Structurally the Promontory Range is typical of the

mountain ranges of the Basin and Range province. The range is elongate north-south (approximately 30 miles long) and averages six miles wide. A northeast-southwest high-angle fault divides the Promontory Range into northern and southern structural blocks. The characteristic structural features are large fault blocks bounded by high-angle faults. Folding is minor, except in the northern portion of the range. One overthrust fault has been recognized in the west-central portion of the area. It is the oldest structural feature in the Promontory Range.

The Laramide orogeny is represented by (1) evidences of overthrusting, presumably from the west, by (2) tight, locally overturned folds which trend approximately north-south, and by (3) minor high-angle reverse faults and major high-angle normal faults. This later faulting has an approximate north-south and east-west pattern and has formed large tilted fault blocks, mostly without strong topographic expression. Gravity surveys indicate that border faults exist below the alluvium along the western and eastern sides of the range, but their topographic expression is not clear. These would belong to the Basin and Range system.

Microfilm \$4.85; Xerox \$17.10. 378 pages.

IMPACT MECHANICS AT METEOR CRATER, ARIZONA.

(L. C. Card No. Mic 60-5054)

Eugene M. Shoemaker, Ph.D.
Princeton University, 1960

Meteor Crater is a bowl-shaped depression encompassed by a rim composed chiefly of debris stacked in layers of different composition. Original bedrock stratigraphy is preserved, inverted, in the debris. The debris rests on older disturbed strata, which are turned up at moderate to steep angles in the wall of the crater and are locally overturned near the contact with the debris. These features of Meteor Crater correspond closely to those of a crater produced by nuclear explosion where depth of burial of the device was about 1/5 the diameter of the resultant crater.

Studies of craters formed by detonation of nuclear devices show that structures of the crater rims are sensitive to the depth of explosion scaled to the yield of the device. The structure of Meteor Crater is such as would be produced by a very strong shock originating about at the level of the present crater floor, 400 feet below the original surface.

At supersonic to hypersonic velocity an impacting meteorite penetrates the ground by a complex mechanism that includes compression of the target rocks and the meteorite by shock as well as hydrodynamic flow of the compressed material under high pressure and temperature. The depth of penetration of the meteorite, before it loses its integrity as a single body, is a function primarily of the velocity and shape of the meteorite and the densities and equations of state of the meteorite and target. The intensely compressed material then becomes dispersed in a large volume of breccia formed in the expanding shock wave.

An impact velocity of about 15 km/sec is consonant with

the geology of Meteor Crater in light of the experimental equation of state of iron and inferred compressibility of the target rocks. The kinetic energy of the meteorite is estimated by scaling to have been from 1.4 to 1.7 megatons TNT equivalent.

Microfilm \$2.75; Xerox \$4.00. 74 pages.

GEOLOGY OF THE JACKSON MOUNTAINS, HUMBOLDT COUNTY, NEVADA.

(L. C. Card No. Mic 60-6755)

Charles Ronald Willden, Ph.D.
Stanford University, 1960

The Jackson Mountains, a prominent range near the center of Humboldt County, Nevada, are of interest because the Cretaceous rocks in the range record the effects of a late Cretaceous to early Tertiary orogeny. Such an orogeny has been assumed to have effected all of the Great Basin, but the rock record is sufficiently complete to provide positive dating in only a few areas such as the Jackson Mountains.

The oldest rocks in the range are the Permian and older (?) volcanic rocks of the Happy Creek volcanic series which make up most of the northern half of the range. In a few places the Happy Creek volcanic series grades upward into undivided Permian and Triassic rocks, which consist of interbedded clastic sedimentary rocks and basic volcanic rocks, with some shaly and siliceous limestone. The Happy Creek volcanic series is also overlain by an unnamed predominantly limestone unit of Triassic age. A phyllite and slate unit of probable Triassic age is in fault contact with the Permian and Triassic undivided rocks. At several other localities the Happy Creek volcanic rocks are overlain by the early Cretaceous King Lear formation or by the Cretaceous or Tertiary Pansy Lee conglomerate, which are the two units of chief importance in dating the Cretaceous and early Tertiary orogenic events.

The King Lear formation consists of locally derived pebble and boulder conglomerate and interbedded siltstone and graywacke, and lenses of limestone.

The Pansy Lee conglomerate is a pebble conglomerate with considerable interbedded coarse-grained sandstone. The pebbles consist of chert and quartzite completely unlike rocks now exposed in the Jackson Mountains.

Dioritic rocks were intruded both before and after the King Lear formation was deposited. Granodioritic intrusive bodies in the range cut rocks no younger than Triassic but the granodiorite is believed to be of late Cretaceous or early Tertiary age.

Tertiary intrusive and extrusive volcanic rocks and sedimentary rocks are widely distributed along the east side and south end of the range.

The most extensive tectonic feature of the Jackson Mountains is the Deer Creek thrust, which is discontinuously exposed from Rattlesnake Canyon northeastward to the north side of Deer Creek Peak. The thrust has brought the Happy Creek volcanic series over the King Lear and Pansy Lee formations, and thus it is of late Cretaceous or early Tertiary age.

An earlier period of Cretaceous deformation is shown by a northeastward-plunging syncline in the King Lear formation on the southeast side of King Lear Peak.

Pre-Cretaceous deformation is shown by a tight fold in limestone of the undivided Permian and Triassic unit beneath the King Lear formation at the mouth of Rattlesnake Canyon.

The late Tertiary deformation was almost exclusively a response to vertically directed stresses, which generally produced high-angle faults rather than folds. The range has probably been uplifted principally by displacement on faults that are buried beneath the alluvium some distance to the east and west of the range.

Ore deposits in the range include some small but high-grade iron deposits, some low-grade quicksilver deposits and some small copper prospects.

The iron occurs in veins that cut the Happy Creek volcanic series or as replacement bodies near the contact between diorite and the Happy Creek volcanics. Bleached volcanic rocks that are cut by numerous closely spaced joints with a film of hematite in the volcanic rock on either side of the joints suggest that the iron of the iron deposits has been derived from the Happy Creek volcanic rocks. The diorite intrusives may have provided heat and solutions to mobilize the iron of the volcanic rocks.

Microfilm \$2.75; Xerox \$7.00. 146 pages.

HEALTH SCIENCES

HEALTH SCIENCES, GENERAL

OCCUPATIONAL INJURIES TO THE LOW BACK

(L. C. Card No. Mic 60-3288)

Marcus B. Bond, M.D., D.I.M.
University of Cincinnati, 1960

Occupational injuries are those that occur at work and for which the employer assumes the responsibility for

medical care and rehabilitation of the injured, and in addition pays a part of his normal earnings while he is disabled. Low back injuries are common in all industry.

While occupational injuries vary in the severity of their consequences, almost all employers and industrial physicians report that injuries to the low back are the most troublesome. Insurance companies that write workmen's compensation insurance attest to this. The great number of articles about low back injuries in the medical literature is further evidence of the interest of physicians who handle these cases.

A review of the American and some of the late European literature on low back injuries has, therefore, been carried out. This was felt to be necessary, because even the recent articles on this subject present differences in concepts of pathology, diagnosis and treatment, and there is variation in the emphasis on compensation and psychological factors.

The concept of workmen's compensation laws and practices is first discussed. Many physicians feel they are handicapped in treating persons with work injuries, because the patient will be paid while disabled. This can lead to exaggeration of symptoms, upon which the physician normally depends so greatly for diagnosis and evaluation of treatment. The laws pertaining to workmen's compensation have been amended frequently. Each state has its own laws, which differ from those of other states and from the Federal regulations which apply to certain industries. Almost everyone agrees that the compensation laws are desirable in principle, but the details are subject to much controversy. It is essential that physicians who treat persons with industrial injuries be familiar with the laws and practices in their particular states.

The anatomy of the back is reviewed in some detail because it is mechanically complex, especially in the lumbosacral area. The lumbar and sacral areas are together called the low back. The lumbosacral joint is the junction of the upper flexible and the lower fused spine and is, therefore, a site of great stress. Early degeneration is common at this site in man, though rare in lower forms of vertebrate life where the spine is not a weight-bearing structure. Physicians agree that weight-bearing on the extended spine in biped man is the one underlying cause of low back disorders centered in the lumbosacral joint. Anomalous development of various parts of the lower spine is common. Many of the anomalies result in a local weakness and to this extent tend to promote injuries in the course of work or other activity.

Clinical aspects of low back injuries are dealt with under fourteen headings and make up the largest section of the paper. Diagnosis is discussed in detail. Reports of treatment for different types of injuries are tabulated and discussed. In addition to these traditional clinical aspects, psychological factors, rehabilitation, and aggravation of pre-existing disease by injury are discussed.

The last section of this dissertation presents the positive approach to the problem of low back injuries, which is prevention. Within an industrial setting, several disciplines must work together to achieve the most in prevention of injuries. Occupational medicine is only one of these, while some of the others are engineering, maintenance, education and training. These are discussed separately with emphasis on the functions of the medical department. Preplacement medical evaluation is treated in detail, especially with regard to roentgenograms of the low back of job applicants.

Outstanding is the fact that careful epidemiologic surveys have not been reported. Authors have concentrated on clinical aspects. One can conclude that a multi-disciplined approach to prevention of these injuries will be rewarding. Suggestions for further retrospective study are made. Prospective studies should be done, and methods are suggested.

Appendixes I and II are presented as guides for, respectively, a diagnostic classification of low back injuries, and a medical record form for individual cases. The bibliography contains 205 references cited in the dissertation.

Microfilm \$2.75; Xerox \$7.60. 165 pages.

SEQUENTIAL ANALYSIS IN MEDICAL RESEARCH

(L. C. Card No. Mic 60-5188)

James Albert Hagans, M.D., Ph.D.
The University of Oklahoma, 1960

Supervisor: Professor Carl Rupp Doering

The models of sequential analysis were originally developed for use in quality control in industry. In the interpretation of medical experiments, incomplete data, nonnormally distributed (i.e., skewed) populations from which the samples come, and the lack of availability of large numbers of experimental subjects create problems which, if not unique to medical experimentation, at least are sufficiently different from those of industrial quality control as to require special attention and consideration.

Making use of the central limit theorem and the approximation to normality achieved by means of random samples of appropriate size n , determined by satisfactory range/constant estimates of σ_x , a model of sequential analysis is described for measured data which yields approximate probability statements and should be useful for these situations in biological and medical experimentation.

Empirical evidence of the model's usefulness is presented by random sampling from known distributions (normal, rectangular and logarithmic) and also by applying the analysis to five sets of data from medical research, utilizing a small number of the observations rather than the larger number available and previously interpreted by a more standard statistical technique.

The two-sided alternative models of Wald, Armitage, and Hegsted and Drolette are also discussed as they relate to the problems of medical research. Empirical evidence suggests that the model of Armitage is preferable.

Microfilm \$2.75; Xerox \$4.20. 76 pages.

HEALTH SCIENCES, NURSING

CAREER PREFERENCES AND PLANNING OF HIGH-RANKING SENIOR STUDENTS IN COLLEGIATE SCHOOLS OF NURSING

(L. C. Card No. Mic 60-6063)

Dorothy Mae Major, Ed.D.
Indiana University, 1960

Chairman: Dr. Raymond C. Gibson

Problem. The problem of the research was to explore the extent and nature of career planning among high-ranking senior students in collegiate nursing programs, with special attention to planning for careers in teaching.

Procedure. Data were obtained through interviews with 100 nursing students in 16 collegiate programs in the midwest, with participants randomly selected from the upper one third of each senior class. Interview items dealt with: career planning, educational experiences, guidance experiences, and attitudes toward careers in teaching.

Interviews were tape-recorded and responses punched on cards for mechanical tabulation.

Findings and Conclusions. Findings were: (1) one half of the students had entered nursing with no career goal in mind, (2) a majority held some career goal at the time of interview, (3) nursing service and nursing education each attracted over one third of the group, (4) preferences were influenced by personal experiences and the desire for work with patients; three fourths had had no guidance from faculty, (5) one fourth considered staff nursing the least desirable nursing position, (6) one half had no plans for a beginning position, (7) students were happy in nursing, a majority preferring the clinical aspect to the theoretical, (8) three fourths criticized some aspect of curriculum particularly repetition and duplication of course content, (9) pediatrics, obstetrics, and psychiatry were areas most enjoyed by students; obstetrical and pediatric nursing were areas of "best" teaching, (10) one third had not found nursing subjects sufficiently challenging, (11) two thirds had had no curriculum enrichment, (12) one third had had enriched experiences, usually in research, (13) two thirds had never received faculty guidance in career planning but desired such assistance, (14) two thirds needed financial assistance for advanced study but knew of no sources of assistance, (15) one half felt competent to make a career choice, course work and clinical experiences having contributed to this ability, (16) one half urged increased individual career guidance, (17) three fourths had received no individual suggestions from faculty regarding consideration of teaching, (18) faculty suggestions regarding teaching correlated positively with students' consideration of that career, (19) students interested in teaching saw it as an opportunity to work with young people in a position offering challenge and personal satisfaction, (20) others, not interested in teaching, thought it might separate them from patient care.

It was concluded that: (1) students enter nursing with little understanding of the nurse as a professional worker, (2) there is need for career guidance in nursing schools, (3) nursing students are attracted to all major fields of nursing with more being attracted to teaching than to any other field, (4) nursing faculties seem inactive in guiding students toward selection of individual career goals, (5) students tend to reject careers in staff nursing, (6) nursing students view the clinical and theoretical aspects of curriculum as separate entities, preferring the clinical portion and criticizing certain aspects of the theoretical portion, (7) there is need to examine nursing courses for repetition, duplication, and lack of challenge, (8) there is need to analyze reasons for nurses' marked preferences for certain clinical areas, (9) nursing curricula fail to provide enriched experiences for outstanding students, (10) nursing students lack information essential for career planning, (11) students desire career guidance based on individual counseling, (12) teaching attracts the interest of competent students but faculties do not seem to stimulate or encourage this interest and many students, therefore, lack insight into teaching as a professional career.

Microfilm \$2.75; Xerox \$9.00. 196 pages.

HEALTH SCIENCES, NUTRITION

EFFECT OF VITAMIN B₁₂ AND ASCORBIC ACID ON THE UTILIZATION OF DIETARY PROTEIN IN 20 YOUNG WOMEN

(L. C. Card No. Mic 60-5244)

Ellen Hastings Morse, Ph.D.
The University of Connecticut, 1960

A diet experiment with 20 young women subjects designed to study the effect of vitamin B₁₂ and ascorbic acid on protein utilization was conducted for six weeks. The entire group ate the same basal diet of 40 to 45 gm of protein largely vegetable in origin for a standardization period of two weeks. The next four weeks served as a comparison period during which the subjects received one of four dietary treatments. Group I served as controls on the same basal diet as previously used. Group II ate the basal diet plus a supplement of 1000 mcg of vitamin B₁₂ daily. Group III ate the basal diet plus a supplement of 200 mg of ascorbic acid daily. Group IV received both 1000 mcg of vitamin B₁₂ and 200 mg of ascorbic acid daily in addition to the basal diet. The results were determined for six criteria of protein utilization.

There were no statistically significant differences between treatments on apparent nitrogen balance; however, a very slight effect of the interaction of the two vitamins was noted.

The erythrocyte counts were significantly greater for the groups receiving vitamin B₁₂ supplementation than for those not receiving this vitamin. A positive response to ascorbic acid also approached significance. There was no indication of an interaction between the two vitamins.

Neither ascorbic acid nor vitamin B₁₂ had an appreciable effect on hemoglobin concentration.

While the main effects of either vitamin on non-protein nitrogen and amino acid nitrogen were non-significant, the effect of the two together approached significance.

Total serum cholesterol was not affected by treatments. However, of interest was the fact that the average serum cholesterol levels of the groups of 20 subjects dropped during the period of six weeks on the vegetable protein, low fat diet.

The use of values obtained during the standardization period for covariance adjustment of those obtained during the comparison period resulted in appreciable reduction in the size of the experimental errors.

Microfilm \$2.75; Xerox \$4.20. 79 pages.

HEALTH SCIENCES, PATHOLOGY

STUDIES ON AVIAN ENCEPHALOMYELITIS

(L. C. Card No. Mic 60-5236)

Jen Hwang, Ph.D.
The University of Connecticut, 1960

Studies were made to explore the possibility of propagating the virus in vitro with the aim of utilizing possible

cytopathogenic changes as means for virus isolation and neutralization tests. Cytopathogenic changes in the inoculated chick kidney cell culture were observed after four serial passages. The cytopathogenic changes were the enlargement of the nuclei, the formation of basophilic intranuclear inclusions, and cytoplasmolysis of the host cells. The 10th passage virus was identified by histopathological and serological methods. The modification of the virulence of the virus for chicks and plaque-forming activity were observed. The kinetics of the *in vitro* virus synthesis was measured by using different virus concentrations in the inoculum, incubation at 30, 36, and 41 C, and a medium of pH 7.8 and 7.4. Attempts to propagate the virus in kidney monolayer cell cultures of the calf, rhesus monkey, puppy, rabbit, pig, guinea pig, and chin-chilla as well as in chicken testis, chicken embryo brain, liver and decapitated embryo failed. The virus also failed to multiply in suspended cell cultures of chicken kidney, testis, chicken embryo brain, chorio-allantoic membrane and decapitated embryo. Virus isolation by chick kidney cell culture passages was found to be superior to chick inoculation method. Evidence was presented to indicate that the virus neutralization test using sera from acute cases and breeding flocks may be employed as a rapid diagnostic tool. The virus was found to survive at 37 C and -20 C for at least 12 days and 17 months respectively.

Microfilm \$2.75; Xerox \$6.20. 128 pages.

HEALTH SCIENCES, PHARMACY

THE PERMEABILITY OF RED CORPUSCLES TO VARIOUS WATER-SOLUBLE ORGANIC IODINE COMPOUNDS

(L. C. Card No. Mic 60-6680)

Lorne Albert Schnell, Ph.D.
The University of Florida, 1960

It is recognized that in discussing the permeability of the erythrocyte membrane to various chemical substances, close attention must be given not only to the nature of the penetrating substance, but also the intrinsic properties of the membrane itself. The hemolytic method, employed throughout the investigation, has proven of value in furthering our knowledge of the red blood cell and its many intricacies, as well as the penetration properties of various classes of chemical compounds.

It was the purpose of the present investigation to continue the inquiry into the penetration effects of certain compounds with respect to the human erythrocyte membrane. The class of water-soluble organic iodine compounds used as contrast media in certain radiological procedures was chosen for this study because they are of pharmaceutical importance and are administered parenterally in grossly hypertonic concentration.

Employing the hemolytic method, the degree of hemolysis of human erythrocytes in solutions of varying concentrations of these compounds was determined quantitatively. To provide a basis for interpretation of the results obtained, the van't Hoff factor, i , was calculated

from hemolytic data for each compound. Values of i were also calculated from freezing point data to further aid in the interpretation of hemolytic i values.

All compounds investigated, with the exception of sodium methiodal, yielded hemolytic i values which were higher than would be expected from their formulae. Experiments conducted in the presence of 0.2 per cent sodium chloride revealed that not all these elevated i values were depressed by the presence of the salt. Hemolytic values of i which are higher than expected might be ascribed to loss of electrolyte from within the cell; this abnormal exosmosis is often corrected by the addition of a small quantity of an electrolyte.

Experiments were also conducted using, instead of defibrinated blood as originally employed, whole blood containing heparin sodium as an anticoagulant; the purpose of this technique was to determine if the removal of fibrin and/or the addition of heparin sodium to a blood sample at all affected the permeability of the erythrocyte membrane to compounds under study. Hemolytic results with the organic iodine compounds indicated that, insofar as the calculation of hemolytic i was concerned, the use of heparinized blood yielded values which were within experimental error of those obtained with defibrinated blood for all but three compounds. Sodium iodomethamate, iodipamide sodium, and iodipamide methylglucamine all displayed values which were significantly lower when heparinized blood was employed.

Values of i , calculated from freezing point data obtained by this worker, revealed that all compounds in question were dissociating normally in solution, i.e., compounds dissociating into two ions yielded values which approached two, and those dissociating into three ions, values which approached three.

The data obtained in this investigation by the hemolytic method suggested that the compounds studied did not penetrate the erythrocyte membrane; and thereby afforded a degree of protection of the erythrocyte against hemolysis; liberation of oxyhemoglobin occurred only in hypotonic solutions of the compounds investigated.

Microfilm \$2.75; Xerox \$8.60. 189 pages.

HEALTH SCIENCES, PUBLIC HEALTH

THE RELATIONSHIP OF CULICOIDES (DIPTERA, CERATOPOGONIDAE) TO THE TRANSMISSION OF THE VIRUS OF EASTERN EQUINE ENCEPHALITIS.

(L. C. Card No. Mic 61-428)

John Earl Scanlon, Ph.D.
University of Maryland, 1960

Supervisors: Dr. William E. Bickley and
Dr. Robert J. Byrne

Field and laboratory studies were conducted to determine the possible role of *Culicoides*, biting midges, in the transmission of the virus of eastern equine encephalitis (EEE) in Maryland. This disease has generally been

regarded as mosquito-borne, but the isolation of the virus from a pool of *Culicoides* in Georgia in 1957 raised the possibility that these midges might also be involved in the disease cycle.

Populations of *Culicoides* were studied by means of light traps and other collecting methods in two areas of Maryland. In one area equine cases of EEE have been observed with some regularity in recent years; in the other area none had been detected since 1933. Over one million midges were collected in 1959, distributed among 34 species. Five of these species had not previously been reported from Maryland, and seven were new to science. The population trends of all of these species were examined, but none was shown to display a significant degree of correlation with the 1959 Maryland epizootic, which involved 17 horses. The *Culicoides* population appeared to be considerably higher in the non-epizootic area. Observations were also made on the biting habits, breeding sites, and other elements of the biology of *Culicoides*.

Methods were developed for rearing and maintaining *Culicoides* in the laboratory, and for safe handling of infected midges. In 26 trials, *Culicoides variipennis* (Coquillett) and *C. crepuscularis* Malloch failed to transmit the virus of EEE from viremic chicks to normal chicks. Refeeding occurred in from 5 to 21 days after the infective blood meal. The virus was detected in substantial quantities in suspensions of the midges immediately after they had fed on the donor chicks, and in decreasing quantities for approximately seven days thereafter. Control groups of *Aedes aegypti* (Linnaeus) mosquitoes were fed on viremic chicks at the same time as the midges, and were maintained in the same constant temperature cabinet. The mosquitoes transmitted EEE virus to normal chicks in from 6 to 54 days after the infective meal. Virus was also recovered from the mosquitoes by trituration and inoculation in chicks at various intervals up to 54 days after infection.

The persistence of EEE virus in *Culicoides* for up to seven days may explain the isolation of the virus from midges in nature; and it indicates the possibility that further isolations may be made if the midges are tested during periods of EEE virus activity. Mechanical transmission of EEE virus was obtained by interrupting midges as they fed on a viremic chick and immediately placing them on normal chicks. The relative stability of EEE virus might permit any blood-sucking arthropod to transmit it in this manner, but it could not be of great significance in the natural cycle of the virus.

It was concluded that the biting midges are not important in the epidemiology of EEE in Maryland. According to the most widely held present day theory the basic cycle of EEE consists of bird-to-bird transmission of the virus in freshwater swamps. The vector in this cycle is believed to be the mosquito, *Culiseta melanura* (Coquillett). At times the virus expands from the basic sylvan cycle to affect mammals and bird species which are not usually involved. At such times other species of mosquitoes may function as biological vectors and mechanical transmission by a variety of blood-sucking arthropods, including *Culicoides*, may occur. Microfilm \$2.75; Xerox \$9.25. 204 pages.

HEALTH SCIENCES, SURGERY

PHYSIOLOGICAL EFFECTS OF TRICUSPID INSUFFICIENCY

(L. C. Card No. Mic 60-6443)

Luis Lionel Gonzalez, M.D., Sc.D.
University of Cincinnati, 1960

The future surgical management of various cardiac valvular deformities seems certain to include more widespread use of prosthetic devices. Even after applying the newer surgical techniques available today there remain far too many patients in whom the nature of their valvular deformities deters any surgical approach. The advent of open heart surgery dictates a thorough knowledge of normal and abnormal cardiac valvular function.

Numerous fundamental problems must be solved in attempting to devise functional mechanical valves. The relatively low pressure system of the right side of the heart makes the tricuspid area ideal for solutions to some of these problems. This study was prompted by the discovery that some dogs in whom tricuspid prosthetic replacement had been performed had apparently tolerated a high degree of tricuspid incompetence. In order to better understand the function of tricuspid valve, the following experiments were carried out.

Total tricuspid valve excision was carried out in a series of twelve adult mongrel dogs under direct vision utilizing inflow occlusion. There were no operative deaths and the immediate post operative course was unremarkable. Cardiac catheterization was carried out in nine dogs revealing an equalization of pressures in the right ventricle, right atrium and superior vena cava. Indicator dilution tests were performed in some and confirmed the presence of severe tricuspid incompetence.

Two of the dogs were autopsied following their death from right heart failure and seven dogs were sacrificed after the signs of right heart failure became evident. Two dogs with partial excision of the valve survived eight and ten months respectively without signs of right heart failure.

Within the limits of four to six months the first signs of right heart failure became evident in the nine dogs under study. Generally the first evidence of right heart failure was the appearance of peripheral edema soon followed by a spotty loss of hair and progressive accumulation of ascitic fluid.

At the time of autopsy, there was obvious evidence of muscle wasting in spite of peripheral edema. The abdomen was markedly distended with fluid. The lungs and pleural spaces were free of fluid. The right ventricle, right atrium, and atrioventricular ring were grossly dilated. The measured volume of serosanguinous ascitic fluid in these nine dogs varied between 2800 cc. and 8200 cc. with an average of 4655 cc. The congestion of the liver was marked and there were hemorrhagic areas over the surface of the liver in some.

Differential ventricular weights were performed according to the method of Fulton in an attempt to evaluate the presence or absence of right ventricular hypertrophy. In order to establish controls for this determination, the hearts of 50 unselected apparently normal dogs were subjected to the same analysis. Of the nine dogs followed

after tricuspid excision, the right ventricle comprised an average of 42.6 per cent of the total ventricular weight and 34.9 per cent of the total heart weight. The corresponding figures for the fifty control dogs was 30.7 and 25.4 per cent. These figures represent significant right ventricular hypertrophy in the study dogs ($P < 0.001$).

The advantages of utilizing the tricuspid area for ex-

perimental prosthetic valvular replacement to solve many of the basic problems is noted. The consistency with which right heart failure was produced in the dogs in this study makes this previously unreported method a valuable addition to the laboratory for experimental work related to heart failure.

Microfilm \$2.75; Xerox \$3.00. 25 pages.

HISTORY

HISTORY, GENERAL

A CRITICAL ANALYSIS OF THE NEW HISTORY

(L. C. Card No. Mic 61-606)

Brother H. Raphael Erler, F.S.C., Ph.D.
University of Minnesota, 1959

This thesis, A Critical Analysis of the New History, is an effort to study the origin of the New History and to examine the fundamental assumptions upon which James Harvey Robinson built his theory of what the study of history should be if it were to exercise a vital role in the intellectual life of the Twentieth Century. The dissertation begins with the revolt of Robinson against what he believed were the shortcomings of "conventional history," proceeds through his declaration in The New History (1912), and follows up with the promulgation of his views in his own teaching and writing and in the work of his disciple Harry Elmer Barnes. The thesis is, therefore, an examination of one facet of the intellectual history of the United States in the Twentieth Century.

A brief excursion into nineteenth-century historiography by way of examining Robinson's charges that scholars were entirely devoted to political and military history is followed by an investigation into the origins of Robinson's interest in the New History. Most of his views can be accounted for, in part at least, by his concern with making the study of history a significant experience in the lives of his students.

Against the background of the influences which prepared for The New History, the movement itself is studied in its fundamental premises. The chapter "Philosophical Assumptions" explores the evolutionary-behavioristic interpretation of human nature accepted by Robinson and Barnes. Their commitment to such a view of human nature led to their concern with studying the genetic origins of contemporary civilization. This, in turn, led them to their pragmatic-instrumentalist conception of historical study with its concomitant relativistic interpretation and evaluation of the past.

The chapter "Methodological Assumptions" turns attention to the New Historians' insistence that history should include all phases and periods of mankind's experience. The extension of the scope of history involved them in the need for an interdisciplinary study of history. These two methodological assumptions relate the New History to two developments of twentieth-century scholarship: the renewed

interest in social, cultural, and intellectual history, and the growing attention to interdisciplinary cooperation among scholars.

The final sections of the thesis give a brief over-view of the application of the theories of the New History in the work of both Robinson and Barnes and make an effort to suggest areas in which an investigation of their influence on subsequent scholarship might be most fruitful. The full examination of both of these questions has been left open for future study.

The dissertation, A Critical Analysis of the New History, is, therefore, a study of the origin and promulgation of the New History with special emphasis on the theoretical and methodological premises on which Robinson built his theory and Barnes attempted to promote it as a means of making the study of history a significant part of twentieth-century intellectual life in the United States.

Microfilm \$6.60; Xerox \$23.40. 519 pages.

THE AMERICAN PERIODICAL PRESS AND NAPOLEONIC FRANCE, 1800-1815.

(L. C. Card No. Mic 61-516)

Charles Willis Meinert, D.S.S.
Syracuse University, 1960

A study of the American periodical press of this crucial period in the history of Europe and the shaping of the United States serves as a mirror of the times which might be rivalled only by an examination of the American newspaper. The periodicals not only give some clue as to what American people knew about European events, but the form of the reports and the comments made upon them reveal even more about the editors-publishers and the part they played in creating and expressing American opinions about Napoleonic France.

This paper is an investigation of three specific questions suggested by a survey of the periodical press in the years 1800-1815: How accurate was the reporting of French affairs, what was reported and what comment was made, to what extent were propaganda techniques employed? To facilitate the investigation and reveal possible shifts in opinion or regional variations, the topical problems are presented within four chronological divisions, 1800-1803, 1804-1807, 1808-1811, and 1812-1815.

The extant periodicals of the 1800-1815 period are

available on microfilm and differ from newspapers of the era in format, content, and periodicity. In general, periodicals were published weekly, monthly, or quarterly and contained a page of contents, miscellaneous articles, stories, poems, and news. Although the number of subscribers to these early periodicals was not great compared to modern standards, the periodicals were passed on to others and stimulated word-of-mouth discussion which added to their influence.

Results of the investigation revealed that the accuracy of periodical news about the European scene was remarkably good in an era of poor communication and unorganized news gathering services. All major events were reported with no significant omissions, and details such as dates, names, and figures were also printed with acceptable exactness.

The conclusions concerning events reported and American comment were developed within the following groups:

(1) Military news occupied much of the periodical space; the major topics were French campaigns on the Continent, the Santo Domingo campaign, and the project for the invasion of England. (2) Economic news centered around the Continental system which most Americans viewed as unrealistic and the British Orders in Council which caused divided opinion. (3) Political news items revealed little American reaction to Napoleon's coup in 1799 or his assumption of the imperial title in 1804. (4) The major social news item was religion. Most Americans initially saw the revolution and Napoleon as enemies of the Catholic Church and favorable to the growth of Protestantism. Within the area of personal news (5), Napoleon's physical and psychological make-up were a popular topic. His military and civil talents were acknowledged, but his ambition and intolerance of any opposition were criticized.

The propaganda analysis, based on a scheme developed by Leonard W. Doob, indicated that it was revealed propaganda which aimed at segmental integration and little disposition to action that prevailed. Repetition was used to attract attention and control reaction. The editors of these early American periodicals may have been unaware of modern terminology and theory, but they seemed to operate in accordance with many presently accepted techniques of successful propaganda.

Tentative conclusions of a more general nature indicate that there was a shift in American opinion of Napoleonic France, from mildly favorable to negative, then back to the initial reaction. It is also the opinion of the author that there was little regional variation in periodical comment, that no American political party was primarily interested in the welfare of England or France, and that to a large extent, what Americans saw, when looking at Napoleonic France, was a reflection of their own hopes and fears.

Microfilm \$2.75; Xerox \$9.70. 212 pages.

HISTORY, MODERN

ITALO-AMERICAN DIPLOMATIC RELATIONS, 1922-28.

(L. C. Card No. Mic 60-6718)

John Morris Berutti, Ph.D.
Stanford University, 1960

Before World War I, relations between the United States and Italy had been generally friendly. At the Paris Peace Conference in 1919, however, their foreign policies clashed head-on. The United States, under President Wilson, had assumed the leadership of the new order, and refused to recognize the secret Treaty of London. The Italians were therefore deprived of the spoils of war promised them by the Entente Powers in 1915.

The result was that the Italians were left in a state of bitterness and dejection. From their point of view, their "perfidious allies" had betrayed them at the Peace Conference. The bitterness between Rome and Washington which followed Versailles, however, did not last. By October, 1922, when Mussolini personally took command in Rome, relations were almost as friendly as before the war.

The rise of Fascism to power was curiously hailed in the United States as a great victory against Bolshevism, and the return of law and order to a ravaged, anarchical land. Mussolini, with a keen sense of psychological timing and public relations, immediately set about to create the image of a strong and forceful statesman in the minds of the American public.

In their desire to avoid involvement in world affairs beyond the scope of "moral leadership," and in their admiration for authority and order, many Americans both knowingly and unwittingly contributed to the success of Benito Mussolini and Italian Fascism. Enormous coverage was given to the Duce's pronouncements and actions in the American press. It was almost universally favorable; critical statements were usually buried in the back pages.

Mussolini fed upon this popular image and used it to usher in a period of active friendship and cooperation between Washington and Rome. He vigorously participated in an effort to establish a bridgehead of cordiality between the two nations. He was more than adequately supported by Richard Washburn Child, the American Ambassador to Rome. Child later became a publicist for the Fascist regime.

Much of Mussolini's pro-American orientation was largely brought about by his expectations of gains from a policy of friendship toward the United States and Britain. (At heart, he hated and envied the Anglo-Saxon world). When the United States passed its discriminatory Immigration Act of 1924, Mussolini was forestalled from openly denouncing the act, in the manner of the Japanese, because of internal problems and his overwhelming need for American capital. Such a policy brought some juicy plums in the form of oil rights in Albania, an extraordinarily lenient war-debt settlement with Washington, and the flotation of loans in the American market. At no time, moreover, did Washington take a position that could have been interpreted as pressure on the Duce to liberalize his administration. The Coolidge-Mellon Administration viewed the dictatorial and violent nature of the Fascist regime as not being of any concern of theirs.

The Duce continued this friendly policy until he had

secured the necessary dollars from the United States to stabilize his precarious regime. Then, securely entrenched, he began to manifest to a greater degree those attitudes and actions which were inimical to world peace.

Microfilm \$3.40; Xerox \$11.95. 262 pages.

THE ORIGINS OF THE
MILITARY DICTATORSHIP OF
HINDENBURG AND LUDENDORFF

(L. C. Card No. Mic 60-6720)

Jon Marshall Bridgman, Ph.D.
Stanford University, 1960

In August 1916 Hindenburg became the Chief of Staff of the German armies and Erich Ludendorff became the First Quartermaster General. The appointment of these two men severely reduced the political power of the emperor and the imperial chancellor and, although the Bismarckian constitution technically remained in force, in reality Germany came under the dominion of a military dictatorship. This dissertation is a study of the factors which led up to the virtual abdication of the government in favor of Hindenburg and Ludendorff.

The first portion of the dissertation covers Ludendorff's pre-war career during which he rose from an unknown junior officer with no family connections and no influential friends to a position of great power on the General Staff. In 1912 he was instrumental in gaining support for an army bill which increased the size of the standing army by nearly twenty per cent. As a result of his activity on behalf of that bill he made enemies in the military hierarchy and was removed from the staff and sent to a regiment. Here he might have spent the remainder of his career had not the war given him a wider field for his talents. Less than a week after the war broke out his reputation was greatly enhanced by his conspicuous bravery during the assault on Liège. Before the end of August, Moltke sent him to East Prussia as chief of staff of the Eighth Army. Against the Russians Ludendorff together with Hindenburg won a series of brilliant victories during the autumn of 1914.

The bulk of the dissertation is concerned with the bitter internecine struggle between Falkenhayn, the Chief of Staff, and Hindenburg and Ludendorff. The issues ranged from the allocation of reserves to basic strategy, but in the last analysis Falkenhayn knew that his rivals were bent on his dismissal. Hindenburg and Ludendorff found a powerful ally in the person of the chancellor, Bethmann Hollweg, who worked unceasingly to bring about the fall of Falkenhayn. It was not until the summer of 1916 when the military fortunes of the Central Powers dipped to a low ebb, that Falkenhayn's enemies were able to prevail upon the emperor to appoint a new Chief of Staff.

Moderate men like Bethmann supported Ludendorff not only because of a strong dislike for Falkenhayn, but also because they saw in Ludendorff a man who had the will, the technical competence, and the military genius necessary to lead Germany to final victory. The moderates closed their eyes to Ludendorff's shortcomings and they flattered themselves that they would be able to work with him once they had put him in power. They soon discovered the error of their ways for Ludendorff proposed to run the German state

as he saw fit and he summarily dismissed all those who opposed him.

This dissertation is based upon the history of the First World War compiled by the imperial archivists during the inter-war period. That history contains excerpts from thousands of documents in the military archives which were later totally destroyed. In addition, the major documentary collections were consulted, along with memoirs, contemporary newspapers, and official publications.

Microfilm \$3.45; Xerox \$12.15. 266 pages.

THE TEXAS LAND AND
DEVELOPMENT COMPANY

(L. C. Card No. Mic 60-5518)

Billy Ray Brunson, Ph.D.
Texas Technological College, 1960

Chairman: Seymour V. Connor

The Texas Land and Development Company was organized in Plainview, Texas, in 1912, as the local operating company for a group of out-of-state capitalists who, under the aegis of Frederick Stark Pearson, a well-known engineer and promoter, had embarked upon an interesting and unique land speculation scheme on the South Plains of Texas. Pearson's objective was to purchase a large acreage of potentially irrigable farm land, subdivide it, and develop each tract with a house, well, barn, corral, fencing, an irrigation system, and growing crops, for resale to farmers.

This program, conceived by a local Plainview realtor, Milton Day Henderson, had tremendous possibilities, not only for profit for the promoters, but for benefit to the farming community as well. In fulfilling these objectives the Texas Land and Development Company was only partially successful.

The first problem, of course, was to acquire adequate financing. Pearson organized three companies in 1912: Texas Securities Company, Limited, as a holding company for Texas Prairie Lands, Limited, (both chartered in Ontario, Canada) for which the Texas Land and Development Company was the operating subsidiary. Texas Prairie Lands, Limited, issued first mortgage bonds which were sold through a London banking firm in the amount of \$2,433,333.33 to raise the funds necessary. In actuality, Pearson and his associates had subscribed the initial money in order to purchase 61,360 acres of land in Hale, Floyd, and Swisher counties and were repaid from the sale of the bonds.

A sales and development program of considerable ambition was begun in 1913, but the cost of development added to the cost of the land soon exhausted the company's capital. With the agreement of the bondholders, a new loan was arranged in 1914 which subordinated the bonds to \$500,000.00 worth of prior lien notes. In 1914 the assets and liabilities of Texas Prairie Lands, Limited, were assumed by the Staked Plains Trust, Limited, which also assumed the operation of the Texas Land and Development Company. By 1916 development costs had increased more rapidly than sales income, and additional financing of \$425,000.00 was arranged. Again in 1919 the enterprise

depleted its funds and the bondholders of the Texas Prairie Lands, Limited, who held as security the total issue of shares of the Staked Plains Trust, Limited, foreclosed and necessitated a reorganization under which the Staked Plains could liquidate the Texas Prairie Lands Trust and then operate for the bondholders who from that juncture actually owned the Trust.

Winfield Holbrook was placed in charge of the local operation by the new management in 1919. Caught in the agricultural depression of the early twenties, plagued by the necessary repossessions of many of the farms sold during the 1915-16 boom, and nearly ruined by the general depression of the thirties, Holbrook and the Texas Land and Development Company, nevertheless, managed to show some profit during the next two decades primarily by leasing Trust lands to tenants until it could be sold. Consequently, Staked Plains Trust, Limited, was able to pay off some of its indebtedness, and during the forties, when land sales again became profitable, to clear all of its debts. Although all of the land was sold by 1946, final liquidation was delayed until 1956 when the Trust disposed of the mineral rights it had retained and settled a problem connected with its income tax returns.

In the final analysis, the backers of the enterprise spent nearly \$3,500,000.00 in the Plainview area. Their enterprise gave significant impetus to that community's growth and did much to further irrigation farming on the South Plains. Microfilm \$4.90; Xerox \$17.35. 382 pages.

**CORDELL HULL:
A STUDY IN DIPLOMACY—
1933-1941.**

(L. C. Card No. Mic 61-94)

Richard Dean Burns, Ph.D.
University of Illinois, 1960

Rarely has American foreign policy failed so completely to achieve its basic objectives as it did from 1933 to 1941. An ardent devotee of Wilsonian internationalism -- that is, of the sanctity of treaties, freer foreign trade, universal disarmament, and international law --, Cordell Hull set as his goals the maintenance of the status quo and the avoidance of war. Yet by the end of 1941, the United States had lost its struggle for the status quo and had become involved in wars both in the Atlantic and Pacific.

Cordell Hull (and Franklin D. Roosevelt) sought to substitute principles for power. Unfortunately neither the Germans nor the Japanese were willing to restrict their foreign policies to talk and the trading of insults. They had built their programs on the traditional assumption that any nation has the right to resolve its internal and external dilemmas, whether genuine or imagined, by force if necessary. This proposition Hull and Roosevelt emphatically denied. They insisted that international law (and pointed endlessly to the Kellogg Peace Pact for precedent) held that no nation should attempt to settle its disputes, no matter how vital the issues at stake might be, by military means. Having established its empire through diplomacy and war, the United States now evoked principles to deny the use of force to modern revisionist powers.

Essentially, this study examines Hull's foreign

philosophy. Delving into the intellectual climate existing within the Administration generally, and the State Department in particular, it traces the development of major policy decisions. Focusing its attention largely on Europe and the Far East during the years 1933 to 1941, this study utilizes a frame of reference which insists on the necessity of striking a balance between the ends and means of policy.

To more clearly understand Hull's aims and the factors that motivated his actions as Secretary of State, the initial chapter reviews his youth, his early political offices, and his lengthy Congressional career. Certainly the Tennessee's constant goal was the reduction of world trade barriers. Therefore, the basis of Hull's economic convictions and the significance of these convictions to his foreign policy decisions has been examined. Subsequent chapters trace Cordell Hull's influence in the formulation of policy to meet the issues and events arising both in Europe and the Orient.

Material for this study has been drawn largely from State Department documents printed in the yearly series of the Foreign Relations of the United States, 1933 to 1941; the records of the Congressional investigation of the Pearl Harbor attack; State Department collections, including the Commercial Policy Series, the Bulletin, and the Press Releases; the private papers of Cordell Hull (to 1933), Senator Key Pittman, and Senator Tom Connally in the Library of Congress; the Senate Foreign Relations Committee manuscripts in the National Archives; published British and German documents; the memoirs, diaries, and private papers of American, British, and Italian officials; and the major secondary works of this period.

Microfilm \$4.55; Xerox \$16.00. 355 pages.

**LINCOLN'S ATTORNEY GENERAL:
EDWARD BATES AND
THE CONSERVATIVE MOVEMENT.**

(L. C. Card No. Mic 60-6784)

Marvin Russell Cain, Ph.D.
University of Missouri, 1960

Supervisor: James L. Bugg, Jr.

The years preceding the Civil War witnessed the struggles of moderate men who desired to maintain the Union intact by compromise and strict adherence to constitutional procedure. Such a man was Virginia-born Edward Bates who ranked as one of Missouri's most prominent political leaders. As a staunch Unionist and a faithful Whig, however, he regarded the controversy over the extension of slavery into the territories as a dangerous threat to national cohesion. He blamed the decline of the Whig Party on the exertions of unscrupulous northern abolitionists and southern Democrats who used the slavery issue to further their own sectional or selfish ends. Embittered by these developments, Bates decided to affiliate with the heterogeneous Republican Party and enter into its councils. As a Presidential candidate in 1860, he initially won considerable support in the middle west and among some of the eastern Republican leaders. Although he failed to receive the nomination, the ex-Whig stood high among the party stalwarts as the secession crisis approached.

Bates entered Abraham Lincoln's cabinet as Attorney General because he felt that the conservative cause must be well represented in the dividing nation. He faced the Sumter crisis with much trepidation but his strong sense of nationalism caused him to support the enforcement of Federal sovereignty over the states. After the war began, Bates attempted to rally fellow conservatives around the standard of executive leadership because he feared the consequences of radical excesses in Congress. Although he supported some of the Administration's more stringent procedures, such as the suspension of the writ of habeas corpus, Bates was recognized as one of the foremost opponents of military government, and the punitive and confiscatory measures proposed by the radicals. As Attorney General, he acted to moderate much of the Congressional legislation which later was the basis of the radical program. He identified himself thoroughly with Lincoln's conservative policies, and thus became a trusted confidant of the President who looked to him for ways to circumvent the vindictive Confiscation Acts of 1861 and 1862. Fulfilling his role as advisor, he was able to influence Lincoln on matters regarding belligerency, arbitrary arrests and early reconstruction measures. Other times, he played an active part in opposing military commanders who usurped civil authority. He was instrumental in having Benjamin Butler, Samuel B. Curtis and John C. Fremont relieved from their commands because of rash acts. Congressmen, cabinet officials and a vast network of judges and law enforcement officers consequently regarded him as a bulwark of conservatism.

In political affairs, Bates exercised much influence among border state conservatives, particularly those from Missouri, and with local politicians who depended on Federal patronage. Bates' prestige began to wane, however, as the radicals grew more powerful. Ill-health and his own apprehensions over the radical movement caused him to contemplate retirement. After making a last, futile bid for the post of Chief Justice of the Supreme Court, Bates resigned in November, 1864 and returned to Missouri. In the midst of the fight against the Missouri radicals, death overtook him in March, 1869. He died longing for the days when his Whiggish nationalism served the conservative faith in which he so devoutly believed.

Microfilm \$5.05; Xerox \$17.80. 394 pages.

THE SAAR PROBLEM
IN FRANCO-GERMAN RELATIONS,
1945-1957.

(L. C. Card No. Mic 60-4834)

Walter Randall Craddock, Ph.D.
The University of North Carolina, 1960

Supervisor: Carl Hamilton Pegg

In the early post-war years France separated the Saar territory from Germany and bound it to the French economy under a special regime technically autonomous but actually under French political tutelage. In order to obtain French support on larger European questions, the United States and Great Britain reluctantly accepted the new status of the

Saar on a provisional basis subject to the decisions of a future German peace treaty.

Following the establishment of the Federal Republic of Germany in 1949, France maneuvered to consolidate the existing status of the Saar on a permanent footing. The Federal Republic in contrast defended German claims to the territory and encouraged irredentist sentiment, which the pro-French Saar Government took stern measures to suppress. The Saar dispute thus generated discord at a time when France and Germany were seeking a rapprochement through cooperation in European federative schemes.

In 1952 the French and German governments undertook negotiations toward a special Saar regime under the aegis of a European authority. The Adenauer government, however, feared to weaken its internal political position by accepting such an accord conceding the separation of the Saar from Germany. France on the other hand feared to agree to German rearmament and sovereignty in the absence of a settlement safeguarding Saar independence of Germany and the Franco-Saar economic union. France accordingly delayed action upon the European Defense Community Treaty until August 1954, when the National Assembly rejected the treaty.

Premier Mendès-France and Chancellor Adenauer then reached a compromise agreement on October 23, 1954 which offered the Saar a new statute under the supervision of the Western European Union. The territory was to retain its economic links with France and yet at the same time free trade was progressively to be instituted between Germany and the Saar. Although the French and German interpretations of the accord differed sharply, both countries ratified the agreement, and it was submitted to the Saar population for their approval. The hitherto suppressed pro-German parties in the Saar engineered the overwhelming rejection of the statute in the referendum of October 23, 1955, and in subsequent parliamentary elections the nationalist parties gained control of the Saar governmental organs.

France then recognized that its former policies were no longer tenable and entered into negotiations with the Federal Republic with the aim of safeguarding French economic interests in return for conceding the reunion of the territory with Germany. The Federal Republic agreed to the canalization of the Moselle River and granted France rights to exploit the Warndt coal deposits in the Saar. The bitter Saar dispute was eventually brought to an end by a Franco-German treaty of October 27, 1956, under which the territory reverted politically to Germany on January 1, 1957, but retained its economic union with France until July 1959.

Though it is still premature to reach firm conclusions, it does not appear that the Saar quarrel seriously harmed Franco-German efforts toward friendly cooperation. The ultimate solution through the restoration of the territory to Germany has of course greatly augmented German industrial power, but this fact might not be of fateful consequence if France and Germany continue to cooperate as at present, and if both remain associated with the western nations.

Microfilm \$6.95; Xerox \$24.55. 545 pages.

THE NEW DEAL'S SEC

(L. C. Card No. Mic 60-6665)

Ralph Fortes de Bedts, Ph.D.
The University of Florida, 1960

Man's attempts to preserve integrity in the realm of financial transactions have proved least successful in that portion dealing with protection for the investor from the dishonest issuer of securities or stock broker. From the formation of joint-stock companies through speculative ventures like the South Sea Bubble and into the twentieth century the investor, urged by a capitalist society to invest his funds in its expansion, has nevertheless had scant protection from those who wished to exploit this urge. The New Deal answer to this need for reform in the financial world was the Securities and Exchange Commission. Through this regulatory administrative agency Franklin D. Roosevelt and the New Dealers achieved many of the reforms attempted unsuccessfully by the Progressives. Through the financial reforms legislated into the SEC the New Deal achieved the necessary restoration of the investor's confidence, and demonstrated its intent to preserve and strengthen the capitalist structure rather than to destroy it.

A Senate investigation of excessive manipulation and short selling on the New York Stock Exchange, set in motion in 1932 by President Hoover, gained added momentum in the first New Deal administration. Its sensational disclosures helped set the stage for Congressional action to curb the abuses displayed in corporate finance and investment banking.

Three acts were the foundations of the SEC's early years. The Securities Act of 1933 required full disclosure and truthfulness of information regarding stocks offered for sale to the public, and made corporate officials liable for the information they approved. The Securities Exchange Act provided the means to democratize the stock exchanges which persisted in the "private club" philosophy, and created the Securities and Exchange Commission. The Public Utilities Holding Company Act of 1935 provided for the dissolution of utility holding company empires erected for the personal gain of a relative few at the expense of investors and rate-payers.

Franklin Roosevelt played an important part throughout. As a young Progressive State Senator and as Governor of New York, his early concern with the public utilities problem led him to consider the utilities stock-owner as well as the rate-payer. As Presidential candidate his concern included the entire area of securities, the ethical practices of their corporate issuers, and the manipulation of stocks. During his first two administrations, Roosevelt actively led and supported Congressional forces in their enactment of legislation which attacked these problems through the creation and expansion of the SEC.

The SEC itself, described as the agency most thoroughly New Deal in spirit and in numbers, contained a large proportion of young men who combined great competence with dedication and a genuine sense of mission. Its aggressiveness came from moral conviction, vigor of purpose, and the administrative challenge, and was not wildly or militantly evangelistic. The SEC regulatory function was performed through a combination of pragmatic reasonableness and firmness, the success and benefits of which received grudging recognition from most of the financial

world. Joseph P. Kennedy, first chairman of the SEC, contributed importantly to the new agency's success through his knowledge of Wall Street and his persuasive tact. Succeeding SEC chairmen James M. Landis, William O. Douglas, and Jerome Frank displayed an increasing emphasis on the New Deal point of view and an insistent demand for continued financial and investment reform.

The SEC incorporated some of the most fundamental and enduring reforms of the New Deal. In its insistence on integrity in financial practice and by its social control of finance, the SEC furnished an outstanding demonstration of the New Deal attempt to revitalize capitalism.

Microfilm \$4.05; Xerox \$14.40. 316 pages.

TENNESSEE RIVER NAVIGATION:
GOVERNMENT AND PRIVATE ENTERPRISE
SINCE 1932.

(L. C. Card No. Mic 60-6146)

Wilmon Henry Droze, Ph.D.
Vanderbilt University, 1960

Supervisor: Professor Dewey W. Grantham, Jr.

This study examines the role of the Tennessee Valley Authority and of private enterprise in transforming the Tennessee River from a practically-useless stream for navigation into a modern transportation artery. Central to the inquiry is the question of whether or not navigation has suffered as a result of its co-ordinate position in a multiple-purpose program of river planning and development. The dissertation also attempts to evaluate the impact of a new form of transportation on the economy of the Tennessee Valley. The work is based largely on primary materials, including government documents, publications and records of the TVA, newspapers, professional journals, and trade magazines. Manuscript materials and personal interviews have supplied much information.

The first two chapters deal with the attempts to improve the river for navigation prior to the creation of the Tennessee Valley Authority in 1933. The next five chapters are devoted to the history of the TVA's efforts to plan, build, promote, manage, and utilize the waterway. Chapter eight examines the impact of the completed channel on industrial, agricultural, and recreational developments in the valley and the Southeast. The last chapter is an overview of the study.

When the TVA undertook the development of the Tennessee River, its major concern was the creation of a yardstick with which to measure the fairness of private utility rates and the rehabilitation of a region which had not shared equally with other areas in national progress. The agency apparently felt that river transportation would not contribute greatly to its over-all goal of rebuilding the human and natural resources of the watershed area. The generation and sale of electrical energy seemed to be the magic formula with which to heal the valley's permanent economic illnesses. Since the project was expected to be self-supporting the developmental program was limited by power marketing possibilities. Such a control over the agency's construction activities aroused the

opposition of local interests and valley Congressmen. The emphasis on power development provided private utilities in the region with an opportunity to challenge the Authority's constitutional foundation. The threat of unconstitutionality and the demands for an enlarged developmental program forced the TVA and Congress to reconsider the building scheme and the constitutional basis of the Authority. The climax was reached in 1936 when the Supreme Court upheld the constitutionality of the valley authority.

These events forced the Authority to focus greater attention on its navigation function. Navigation became a primary part of the multiple-purpose program. The construction program was expanded and greater emphasis was placed on the improvement of the main river for water transportation. As the channel was lengthened and deepened and as traffic began to increase, the corporation began to realize that its waterway provided a valuable means of accomplishing its over-all goal of regional rehabilitation. Having reached this conclusion, the agency embarked upon a policy of promoting the use of the waterway. The Authority's efforts enjoyed substantial success for, as the navigation system neared completion in 1945, the tonnage hauled on the river grew steadily larger. After World War II traffic on the stream expanded even more rapidly.

With the traffic increase there developed an inter-regional trade between the valley and the upper Mississippi, the Ohio, and the Gulf Coast states. The trade balance favored the shippers outside the TVA watershed but this was no serious disadvantage to valley residents. It actually aided the valley's economic growth. Distribution, processing, and manufacturing industries emerged to handle the incoming products. Cheap power and cheap transportation worked together to attract industrial capital. The improvement of the river for nine-foot navigation also influenced southern agriculture. A milling industry, utilizing grains from the Midwest, developed along the river from Chattanooga to Florence. Cheap water freight rates reduced the price of animal feeds for the farmer. The reduced cost of feeds encouraged the growth of the broiler and livestock industries. In Georgia, the poultry industry has become a rival of cotton production as an income producer!

Several conclusions may be drawn from this study. The TVA has established a first-rate navigation system. Navigation has not suffered as a result of having been made a co-ordinate part of a multiple-purpose improvement scheme; navigation is a cardinal element in the TVA program. Promotion of the waterway was a wise decision for it has resulted in greater public benefit from the navigation investment. The improvement of the Tennessee River for navigation has had a beneficial effect upon the industrial and agricultural growth of the valley and the Southeast. Private enterprise did not share in the building of the navigation channel, but it has co-operated fully with the Authority in seeing that the channel is used and in furnishing the carrier services for shippers. Many obstacles to the full development of the river remain. The shipper with less to freight than a barge-load still finds it difficult to utilize the waterway. There is still not a complete integration of water and land commerce because of the competition between the railroads and the water carriers. As these barriers to the full utilization of the water artery are eliminated, greater benefits may be expected to accrue to valley citizens and those in other regions as a result of the improvement of the Tennessee River.

Microfilm \$5.55; Xerox \$19.80. 436 pages.

TEXAS AGRICULTURE, 1880-1930.

(L. C. Card No. Mic 60-6616)

Samuel Lee Evans, Ph.D.
The University of Texas, 1960

Supervisor: Barnes F. Lathrop

This study emphasizes crops, livestock, and farmers. The story of cotton, the principal crop of the Texas farmer, is told in two chapters; one devoted to the delimitation, through dot maps constructed from data published in successive U. S. decennial censuses, of the geographical distribution of cotton and to a description of the implements utilized and the methods followed in cultivating the crop. The second chapter describes the major diseases and insect enemies of cotton; root rot, Johnson grass, the boll weevil, the pink bollworm, the cotton caterpillar, and the bollworm, and the methods perfected and programs employed to meet these threats.

The distribution of the major grain crops of Texas, corn, oats, grain-sorghum, wheat, and rice, are shown through dot maps and the cultural practices and methods of combatting the major grain pests are discussed.

From time to time throughout the period considered Texas farmers expended considerable energy in attempts to establish paying ventures based upon peaches, figs, citrus fruits, vegetables, nuts, sugar cane, and apiculture. These attempts are narrated and the magnitude of each effort is shown through the mechanical device of the dot map.

Two chapters are devoted to Texas livestock; beef and dairy cattle, in one; and horses and mules, swine, sheep, goats, and poultry, in the other. The increase in the numbers of animals of each class from decade to decade is shown through the medium of the dot map, and descriptions of the evolution of the livestock industry are given with particular emphasis upon the efforts to improve the quality of stock and to counter the effects of diseases and insect pests.

Although considering farming a "way of life," Texas farmers were most happy when financial returns were high. In attempts to obtain just monetary rewards they founded general agricultural organizations. As each general organization failed farmers turned to political action for relief. In tracing this movement the activities of the Grange and Greenback Party, the Farmers' Alliance and the People's Party, the Farmers' Union, and the Farm Labor Union are narrated.

In contrast to the general farm organizations was the Renters' Union of North America. Tenancy was well established in Texas in 1880, and it grew steadily thereafter. During the first years of the twentieth century the condition of the tenant appears to have deteriorated appreciably bringing about considerable discontent. Protests were voiced through the short lived Renters' Union of North America aimed mainly at revising the systems of land tenure and taxation. Material success was not achieved because of hostile public opinion, lack of finances, and a socialist oriented leadership. This movement is detailed in a separate chapter.

In addition to general farm organizations and to the renters' union the more substantial farmers of Texas co-operated to elevate the position of agriculture through the

improvement of rural education and the perfection of marketing agencies. This is shown through a description of the activities of the Texas Farmers' Congress, the State Farmers' Institute, and the Texas Farm Bureau Cotton Association.

None of the above attempts succeeded. Herein lies the explanation of the farmers' enthusiastic acceptance of the first New Deal agricultural programs and their present reluctance to abandon government regulation.

Microfilm \$6.45; Xerox \$22.75. 505 pages.

**ALEXANDER CAMPBELL
AND THE CHRISTIAN CHURCH
IN THE SLAVERY CONTROVERSY**

(L. C. Card No. Mic 60-6289)

Robert Oldham Fife, Ph.D.
Indiana University, 1960

The Christian Church (Disciples of Christ) is an American religious body which developed from several streams of religious "reform" in the nineteenth century. Alexander Campbell (1788-1866) became the guiding genius of the movement prior to the Civil War.

Spreading westward with a vigor characteristic of the nation, the Christian Church found its major strength in the border states. This subjected it to the full force of the slavery controversy.

From the time of his participation in the Virginia Constitutional Convention of 1829-1830, Campbell advocated the gradual abolition of slavery through the pages of his monthly periodical, the *Millennial Harbinger*. Campbell distinguished between the simple relationship of master and slave, and the institution of American slavery. He believed the former was not necessarily immoral in itself, while in tendency and fruits the latter was contrary both to the Bible and the "spirit of the age." In this view he was followed by many Disciples.

Campbell eschewed overt political or social action on the part of the Church. The mission of the Church was to convert the individual, and he was to carry his Christian principles into every phase of life. By this "reflex light" every social evil, including slavery, could be "abolished by the gospel." In keeping with this position, Campbell urged the Christians of Kentucky to write an antislavery constitution in 1849.

Among Christian Churches of the South, membership of both slaves and masters in the same congregation was common. Unlike some other religious bodies, the Disciples did not widely cultivate separate Negro congregations.

There was some interest among Disciples in the work of the American Colonization Society. Yet, even though the American Christian Missionary Society sent an emancipated slave as a missionary to Liberia, interest in colonization did not attain significant proportions.

Most periodicals of the Church followed a "neutral" policy respecting slavery. The increased tension which accompanied passage of the Fugitive Slave Law and the Kansas-Nebraska Act, led to the establishment of the *North-Western Christian Magazine*. This was the first abolitionist periodical published among the Christian churches.

Disciple abolitionists were confronted by problems of major proportions. They could not countenance "compromise" with slavery, but neither could they condone the work of some "infidel" abolitionists who attacked the Church for its "social blindness." The abolitionist motto, "No union with slaveholders," also ran counter to the plea of the Disciples for Christian unity.

Institutions were likewise affected by the slavery controversy. Considerable friction developed between Bethany College and Butler University on the occasion of the "Bethany Riot." The American Christian Missionary Society's "neutral" policy became displeasing to some, and eventually led to the formation of an abolitionist anti-slavery society. Conventions and other gatherings took various actions respecting the problem, but their pronouncements were not considered authoritative.

Although there were isolated instances of division among Disciples, their interest in Christian unity, and the elasticity afforded by congregational autonomy, saved the Christian Church from general schism.

Microfilm \$4.20; Xerox \$14.85. 327 pages.

**COLONEL RICHARD LIEBER,
CONSERVATIONIST AND PARK BUILDER:
THE INDIANA YEARS.**

(L. C. Card No. Mic 60-6291)

Robert Allen Frederick, Ph.D.
Indiana University, 1960

Adviser: Professor John D. Barnhart

The career of Richard Lieber is at once interesting and unusual. His European birth and education endowed him with certain perspectives which many Americans lacked. From Germany he brought a knowledge of the arts and an appreciation for the historic and the beautiful. The young German also brought with him a love for political liberty which was not enjoyed by his people under the rule of the Kaisers. Although he did not plan to remain in the United States, two years later, in 1893, he married Emma Rappaport and settled in Indianapolis, Indiana.

Between 1893 and 1916, Lieber busied himself in journalism, business, and civic ventures in the Indiana capital. He became well known as an advocate of reform on the municipal and state levels. Astounded at the high insurance rates exacted from the city's businesses and residents, Lieber made a thorough study of the situation. As a member of the mayor's advisory council and a friend of several governors, he was in a position to fight for improvement of the fire-fighting facilities of Indianapolis. After five years work, he succeeded in reducing the insurance rates at a saving of \$150,000 per year to Indianapolis citizens. He also worked for the creation of a state fire marshal, a merit plan for city and state civil servants, and primary election reforms.

Although successful in his business pursuits, in 1916 Lieber turned his attention to working for the creation of a system of state parks as a permanent memorial to the centennial of Hoosier statehood. Three years later, because of his leadership, the General Assembly passed legislation which established the Indiana Department of

Conservation. Richard Lieber became its first director, a post which he occupied for fourteen years.

In this position Director Lieber demonstrated unusual capabilities. The conservation movement in Indiana made highly significant gains because he proved to be both an able theorist and a successful administrator. His direction led to the development of one of the nation's outstanding park systems as a consequence of his philosophy and management. Under his leadership Indiana pioneered in several important phases of park development. Of these the most notable was the policy of making the parks self-supporting and building state park inns of high quality and phenomenal success. By the early 1930's, Indiana, thirty-seventh in size among the states, shared top park honors and conservation reputation with New York and California. Indiana's parks were selected and operated on high standards. During the period the department's work was accomplished on a strictly non-political basis.

The excellence of Lieber's work in Indiana gave him an outreach in the conservation and park world and an opportunity to influence the growth and development of similar ventures in other states. These states benefited greatly from the pioneering of the Indiana parks. In recognition of his leadership in the state park field, he was elected to the presidency of the National Conference on State Parks seven successive years. Following this, he became the first chairman of the board of directors of the conference. Lieber enjoyed the interest and respect of the National Park Service and was acknowledged by federal conservation authorities as an expert in the development of state parks. He influenced the national park philosophy and in the years after 1933 served the National Park Service as a consultant and member of its Advisory Board.

Richard Lieber's contribution to the field of park building and management increased with his age. Even after his resignation from the directorship of the Indiana Department of Conservation, he continued to gain in national stature and reputation. The foundation of his success, however, is to be seen in his Indiana years. Thus, they take on a new and greater significance. The state provided him a natural testing ground of high potential. In time he presented her citizens with parks and memorials of outstanding quality and beauty. To his adopted country he bequeathed a conservation consciousness. To the state park movement he gave a sense of direction.

Microfilm \$5.95; Xerox \$21.20. 468 pages.

THE EARLY LIFE AND CAREER OF EDWIN M. STANTON

(L. C. Card No. Mic 61-298)

Frederick John Graves, Ph.D.
University of Kentucky, 1956

Director: Dr. W. Clement Eaton

Despite the prominence of Edwin M. Stanton as Secretary of War under Lincoln, his true character and accomplishments have been obscured by eulogistic biographers in their accounts of him and by some of his contemporaries in their unfair evaluations. This study covers the period of his life up to the time he entered the War Office in 1862

with special emphasis upon his law career. The obscure early years of his life throw much light on his enigmatic character and go far to explain his success later as Secretary of War.

He was born in Steubenville, Ohio, December 19, 1814, son of a physician of Quaker stock. The death of his father left the family in straitened circumstances and required young Stanton to seek employment to supplement the family income. For a short period he attended Kenyon College but was forced to return home because of family obligations. After studying law at Steubenville, he was admitted to the bar and began his legal career at Cadiz, Ohio in 1836. For approximately a decade he practiced law at Steubenville and in 1847 moved to Pittsburgh. During the following nine years, he appeared before many courts in Pennsylvania and the Ohio Valley. In 1856, he moved to Washington, D. C. to limit his practice to Supreme Court cases. In late December, 1860, he became Attorney-General. From April 4, 1861 to January 20, 1862, Stanton was primarily concerned with practicing law.

Although Stanton never became so deeply involved in politics as to neglect his legal career, he was more interested in politics than earlier biographers assumed.

It has been difficult to interpret Stanton's political allegiance from December, 1860 to January, 1862. As Buchanan's Attorney-General, he secretly communicated with the Republicans. Possibly his concern over the fate of the Union seemed more important than his loyalty to the Democratic party. While highly critical of the new administration until appointed Secretary of War, Stanton assisted the Republicans in prosecuting a significant enlistment case and acted as special counsel to Secretary of War Cameron. In rendering services to his political opponents, he was aware of the possibility of receiving an important political appointment from them.

Stanton's success as a lawyer was largely the result of his college training, his selection of cases that offered him a good prospect of winning rather than earning large fees, his devotion to his legal work, his quick mastery of facts even in complex cases, and his unleashing of every resource in the interest of his client.

Although Stanton generally suppressed his antislavery sentiments, evidences of his hatred of slavery can be seen in his opposition to Ohio's "Black Laws"; in his willingness to defend John Brown in 1859; and in his recommendation that Cameron include a passage in his annual report of 1860 that Negroes be armed.

The character of Stanton was so complex that few of his contemporaries understood him. In many respects, there were two Stantons: one meriting praise and the other eliciting censure. He was not entirely the man described as Lincoln's cold and efficient Secretary of War. His early life and letters reveal him as a devoted husband and father, capable of deep emotions--sensitive, tender-hearted and affectionate. Repeated personal tragedies left deep psychological scars that never healed. Chronic asthma dogged him all his life and affected his disposition.

While many persons have claimed credit for urging Lincoln to appoint Stanton Secretary of War, new evidence has been found that he obtained Cameron's position, in part, as a result of his own efforts or intrigue.

Microfilm \$5.25; Xerox \$18.45. 409 pages.

AMERICAN CIVIL LIBERTIES UNION:
ORIGINS, 1914-1924.

(L. C. Card No. Mic 61-252)

Donald Johnson, Ph.D.
Columbia University, 1960

This study describes the origins and the important activities of the American Civil Liberties Union (and of its predecessor, the National Civil Liberties Bureau) during the organization's early years.

The NCLB grew out of the American Union Against Militarism, a group of middle class pacifists, social workers and socialists who opposed "preparedness" in the years before American entrance in the First World War. When America finally did enter the war, the American Union put up a stiff fight against compulsory conscription. Later it responded to the Selective Service Act of May 1917 by creating a special "Bureau for Conscientious Objectors." The director of the C.O. Bureau was Roger Nash Baldwin, a social worker and a C.O. who was to become a major figure in the civil liberties movement.

In July 1917, Baldwin reorganized his agency into the Civil Liberties Bureau and promised to aid not merely objectors, but anyone whose civil liberties might be denied as the result of the Espionage Act or other repressive wartime legislation. Actually, the character of the new Bureau was substantially the same. Most of its clients continued to be those who were conscientiously opposed to the war. In October 1917, as a result of a fight within the American Union over Baldwin's controversial activities, the Bureau became a separate organization. It was renamed the National Civil Liberties Bureau (NCLB), a name it retained until 1920, when it became the American Civil Liberties Union (ACLU).

The Bureau was too unpopular to be highly influential during the war years. It fought, none too successfully, against a number of abuses which arose under the Espionage Act. The Bureau wanted some of the ambiguous provisions of this act to be clarified; but neither the Post Office, which exercised broad censorship powers, nor the Justice Department, which prosecuted hundreds of people, would agree to the Bureau's demands. The Bureau twice went to court to challenge the right of the Post Office to withhold NCLB pamphlets, and won; but it was never able to win similar victories for other publishers. It helped to defend I.W.W. leaders and others who were prosecuted under the Espionage laws, but the great majority of these defendants went to prison. The Justice Department once raided the Bureau's offices to investigate charges of its subversive activities. On the whole, the Bureau was most successful as an agency for those C.O.'s who were drafted. In negotiations with the War Department, it achieved several important objectives -- the most important of which was the recognition of non-religious objectors.

After the war the ACLU had a wide variety of different goals. For six years it campaigned for an amnesty for the wartime-convicted "political prisoners," the last of whom was not released until 1924. It opposed the federal government's postwar drive to deport alien radicals. The Union denounced the Palmer Raids and helped to expose Attorney General Palmer's illegal actions. The Union led the fight against a series of peacetime sedition bills and helped to defeat them. In West Virginia, in the most dramatic of its many efforts on behalf of labor, the ACLU fought for the

rights of coal miners to organize, meet, and strike.

In Michigan, it helped to defend William Z. Foster and other Communist party leaders whom federal agents arrested in 1923 for violating a Michigan anti-sedition law.

In the last chapter of this study, the author attempts to explain why the civil liberties movement arose at the time it did, and why the ACLU assumed the character and the goals it has. In 1917, the author points out, the federal government for the first time made a concentrated attack upon the liberties of socialists, pacifists, the I.W.W., and other radicals, most of whom had been disunited and unfriendly toward each other before the war. Because of its varied constituency, the C.O. Bureau acted as a civil liberties bureau almost from the beginning. The civil liberties movement grew naturally out of the work for the conscientious objectors to war.

Microfilm \$5.00; Xerox \$17.80. 391 pages.

THE CENSORSHIP EDICTS
OF EMPEROR CHARLES V IN THE
LOW COUNTRIES, 1515-1550.

(L. C. Card No. Mic 61-421)

Louis Augustine Kenney, Ph.D.
University of Maryland, 1960

Supervisor: Professor Richard H. Bauer

The political, religious, technological and intellectual climate of the sixteenth century was favorable to the growth of censorship. Charles V, ruler of the Low Countries, was unaware of the power of the press, but he played an important role in the development of censorship during his reign, 1515-1555.

Suppression of religious ideas began with the punishment of blasphemers. The first censorship law appeared in 1520. It forbade Luther's books. In 1529, with the advice of the Louvain theological faculty, another edict of increased scope added Zwingli, Melancthon, Brussi, Wyclif, Hus, Marsiglio of Padua and Pupperus of Goch to the list of forbidden authors and established regulations for printers. It prescribed death for heretics, forbade the importation of condemned books and required printers to secure the Emperor's permission for every book printed. Heresy suspects were not to hold any office and rewards were authorized for informers.

In 1531 a special edict on the control of the press appeared. It increased the penalty against printers who failed to obtain imperial permission to print from a fine to death on the scaffold. In 1531 Charles confirmed the University of Louvain as supervisor of the press. The government took a major step toward comprehensive censorship in July 1540 when it published a new censorship edict which forbade specific books by title and commanded their owners to burn them or suffer death.

A 1543 edict forbade books derogatory to the Emperor. Penalties for offenders included hanging and confiscation of property. It forbade schoolmasters to use or read condemned books.

In 1546 Charles commanded the Louvain theologians to draw up a complete catalogue of heretical books. Consequently they wrote a new censorship law that contained the

first alphabetical list of forbidden books. It named two hundred seven specifically forbidden books. Another edict in 1546 listed thirty-eight books that were approved for use in the schools.

In 1548 Charles issued the *Interim*, a legal instrument, which he hoped would resolve the religious problem. It forbade the printing of theological works without prior approval of the theologians and all "abusive books." The following year the Emperor ordered the Louvain theologians to draw up still another edict against heretics and to bring the list of forbidden books up-to-date. Accordingly, they prepared a complete new censorship law that was proclaimed an imperial edict in 1550. It enlarged, rearranged and expanded the 1546 and earlier censorship edicts.

The 1550 censorship edict was more than a mere catalogue of forbidden books. It prescribed the relentless harassment of heresy suspects and the direst punishments for the guilty. Officers were commanded to investigate all persons, lay and clerical, and to sentence heretics as directed. It required printers to take an oath to observe the edict under pain of death.

Only approved booksellers could sell printed matter and town officials were required to inspect their shops. No one suspected of heresy could teach school and approved schoolmasters could only use those books designated by Louvain University in their instruction. Fines and suspension from office were prescribed for officials who failed to republish the edict every six months.

This study indicates that: an extreme censorship law developed in the Netherlands during the reign of Charles; at the beginning of his rule, Church and state were relatively tolerant of religious and political thought; by 1550 a cruel censorship law, the legal foundation for the suppression of freedom, was proclaimed; the Louvain theologians and papal legates were the authors of the censorship edicts, but they were issued with the Emperor's knowledge and consent.

Microfilm \$2.85; Xerox \$9.90. 220 pages.

DISRAELI'S CONSERVATISM

(L. C. Card No. Mic 61-301)

Clyde Joseph Lewis, Ph.D.
University of Kentucky, 1956

Supervisor: Dr. Carl B. Cone

Benjamin Disraeli's social and political theories have been usually overshadowed by his colorful personality and his practical achievements, but one group of present day theorists, who may be loosely labeled as the "new conservatives," see Disraeli as a nineteenth century prophet, preaching, in advance of his time, a message of salvation for the lost soul of twentieth century man. The proposition certainly deserves investigation, but the task of investigation is immensely complicated by the enigma of Disraeli, himself. His principles were so obscured by his subjectivity and by his apparent contradictions, that he has often been accused of holding no principles at all.

A careful analysis of Disraeli's career indicates that such an accusation is unfounded. Although he entered poli-

tics as a radical, he considered his radicalism as only expediency, justified by its necessity in resisting dangerous innovations. All of his fundamental ideas were formulated before he joined the Tory party in 1835. From 1835 to 1848, he perfected these principles while winning a position of party leadership; after 1848, he was concerned primarily with the problems of gaining and holding political power, in order that the principles might be applied. There can be little doubt that his theories served to rationalize personal ambitions or that his policies furthered those ambitions, but he was, nevertheless, sincere in his beliefs during the whole course of his career.

Disraeli's mature philosophy was remarkably similar to all conservative theory, although his ideas were marked by his own peculiar viewpoint and personality. He believed that human action was governed by the emotional impulses through which God made His will known to man. Some few people in every society were endowed with a special emotional sensitivity, which caused them to recognize the innate good in selflessness and creativity. The Semitic peoples in general, and the Jews in particular, were also blessed with a peculiar racial inspiration, in order that they might enlighten the rest of humanity. History was a mighty drama, in which the forces of good, following the path pointed out by the Hebrew prophets, strove to spread eternal truths among inferior peoples. In this contest, the true principles could only be maintained when they were identified with traditional institutions, to which, peoples of average sensitivity could feel emotional attachments. The sum total of all such attachments was the national character, which, among non-Semitic peoples, provided safeguards against selfishness, through spiritual appeals to altruism. Disraeli professed to believe that the British constitutional structure possessed these requirements of the ideal polity. Consequently, he believed that the main function of an English statesman was the maintenance of the traditional order by any means at his command.

One may conclude that Disraeli's principles were neither wholly true nor wholly false and that their value depends upon how intelligently they are applied. They are to be commended because they emphasize the importance of the cultural heritage in social evolution and because they suggest that abstract ideals must always be limited in application by the practical requirements of time, place, and human nature. On the other hand, his ideals were necessarily vague and lacked justification for positive action, as required in any dynamic situation. In either case, they can be explained more easily as the natural products of circumstances than as universal moral and political truths.

Microfilm \$3.45; Xerox \$12.15. 266 pages.

FAZENDA CAMBUHY: A CASE HISTORY OF SOCIAL AND ECONOMIC DEVELOPMENT IN THE INTERIOR OF SAO PAULO, BRAZIL.

(L. C. Card No. Mic 60-6686)

George F. G. Little, Ph.D.
The University of Florida, 1960

This dissertation is a case history which describes the evolution of a large tract of land in the interior of

São Paulo, Brazil, from its origin as one of the last Portuguese colonial land grants until it was divided up in 1956. Having begun as an example of colonial expansion, the estate, most of which was covered by tropical forest, lay dormant for some fifty years. The inflow of immigrants to São Paulo in the late nineteenth century, the coming of the railroads, and above all the advance of the coffee frontier transformed the area. The estate, having been given first to a Brazilian colonel, passed into the hands of his daughter, who in turn left it to her nephew, a notable politician of Imperial times in Brazil. In 1911 it was purchased by a Brazilian tycoon, Carlos Leoncio Magalhães, under whom it was changed from a semi-abandoned latifundia into one of the most developed estates in São Paulo at the time. To the 500,000 coffee trees he acquired, Magalhães added 2,500,000 more over a period of thirteen years. A transportation system was provided and large numbers of cattle were fattened on the estate's pastures.

The history of Cambuhy in Magalhães' time is a study of a man with a great deal of land seeking the labor and capital to develop it. The lack of credit available in São Paulo and abroad during and after the first World War made it impossible for the tycoon to carry through his plans to develop the estate further. As a result he sold it to an English company.

Under English rule the estate not only became a fine example of a well run fazenda but seemed to be an experiment in latterday colonialism. Thanks to greater financial resources and increased labor force, Cambuhy became an estate of superlatives producing coffee, cotton, and cereals in quantity and supporting a large cattle development and successful industrial activity.

The effects of the great world depression, the coffee slump, the second World War, and the Vargas regime on the estate are all traced. After the war, Cambuhy moved into the era of scientific agriculture in Brazil as a pioneer becoming a more and more sophisticated economic institution until a point of diminishing returns loomed ahead. After having passed into Brazilian hands, the estate was broken up and the last large colonial land grant in São Paulo ceased to exist.

Parallel to this history of economic development there is presented one of social change. From the era of slavery and almost servile conditions in the early post-abolition years, social relations gradually emerged through a transition stage of paternalistic employer-employee relationships to a point when there existed a body of social legislation guaranteeing the worker his rights. Unfortunately, this freedom was not accompanied by adequate education; and so now the population of the estate need better instruction, more economic aid, better medicine, and much else before they can enjoy the benefits they have acquired.

This history of Cambuhy illustrates in the particular many of the general statements made about the coffee industry in São Paulo, tracing as it does the daily life of Cambuhy as a social and economic institution.

Microfilm \$4.95; Xerox \$17.35. 385 pages.

TEXAS AND THE EISENHOWER CAMPAIGNS

(L. C. Card No. Mic 60-5520)

Edward Lee McMillan, Ph.D.
Texas Technological College, 1960

Chairman: S. S. McKay

Since 1900 a Republican Presidential candidate has carried Texas three times. In 1928 Herbert Hoover did so and in 1952 and 1956 Dwight D. Eisenhower swept the state with decisive majorities. The success of Hoover is usually explained by the fact that his opponent was a Catholic and a Tammany nominee running on a wet plank. The issues in 1952 and 1956 were more complex in nature. The nation was prosperous, and Texas shared in the prosperity. Only the Korean War clouded the horizon of peace and prosperity.

Certain elements of Democratic discontent in Texas had arisen from the administrations of Franklin D. Roosevelt. Texas conservatives saw in the economic and social innovations of the New Deal a wide departure from our free enterprise system. As the New Deal merged into the Truman Fair Deal, Texas Democrats continued to press charges of "creeping socialism" against the national Democratic administration. These internecine struggles destined to influence the outcome of the 1952 and 1956 elections are recorded in Chapter One.

Chapter Two, "The Campaign of 1952," traces the liberal-conservative warfare in both the Democratic and Republican parties. Governor Allan Shivers, leader of Texas conservative Democrats, was vigorously opposed by liberals or loyalists. In the Republican camp in Texas, supporters of General Eisenhower, led by Jack Porter, struggled to wrest state leadership from Harry Zweifel, pro-Taft man. The controversies were carried finally to the respective national conventions for settlement, but their impact was felt in the 1952 campaign, which saw thousands of Texas Democrats leaving their party and contributing thereby to a Republican victory in Texas.

Chapter Three, "Political Developments, 1953-1955," traces the major domestic and foreign policies of those years and measures the impact on Texas political thinking. The Tidelands controversy was of paramount concern to Texans, but other national issues also affected the thinking of Texas voters. Among those were the farm program, civil rights, and Senator McCarthy's activities. Foreign problems typified by the Korean stalemate, the Atoms-for-Peace plan, the Indo-China puzzle, the Formosa crisis, and the 1955 Summit Conference likewise influenced Texas voting behavior.

Events of 1955 and early 1956 sharpened the focus of political attention as the 1956 campaign drew nearer. President Eisenhower's heart attack was a shock to Texans as it was to all other Americans. His recovery was followed closely and hope was expressed early that he would again be the Republican nominee. Early in 1956 the "Dump Nixon" campaign was launched. Chapter Five, "Prospective Candidates and Issues of 1956," analyzes the activities of such Democratic personalities as Adlai Stevenson, Estes Kefauver and Lyndon Johnson.

The last chapter is concerned specifically with the campaign of 1956. Again, as in 1952, Eisenhower and Stevenson were the candidates, both now more skilled in campaigning. Many Texans were wary of Stevenson's insistence on

cessation of the H-Bomb tests and of ending the draft, and had not forgotten his original position on the Tideland, so the Eisenhower program and personality held out the greater appeal to the average Texas voter. The Republicans therefore carried Texas by a larger majority than that of 1952.

Another significant factor in the background of Texas' defection from the national Democratic party was the economic and social complexity of the state itself. Wealth and poverty; Spanish-Americans and Anglo-Americans; oil and cotton; frugality and extravagance; all these diversities characterize Texas and her citizenry and inevitably resulted in the political contradictions evidenced by the Presidential elections of 1952 and 1956.

Microfilm \$5.70; Xerox \$20.30. 448 pages.

THE WHIG PARTY IN MISSOURI

(L. C. Card No. Mic 60-6814)

John Vollmer Mering, Ph.D.
University of Missouri, 1960

Supervisor: Lewis E. Atherton

The history of Missouri's Whig party is the history of a minority. The Whigs of Missouri were a comparatively well-to-do group, whose interest lay in the direction of business and investment. To the suspicion and distrust thus created in overwhelmingly agricultural Missouri, the Whigs added an air of snobbishness, which hardly endeared them to the electorate.

Indeed, the majority Democratic party contained a faction whose financial principles coincided with those of the Whigs in many particulars; but, while they would support them in elections as the lesser of evils, Whigs also denounced these renegade Jacksonians as "nauseous pills to be swallowed." Lacking aggressive leadership, the Whigs were unable to induce these pills to join the Whig party or in any way to reciprocate Whig support in electoral contests. Until 1850 the Whig party in Missouri oscillated between withdrawing from elections entirely and entering them in dilettante fashion, usually suffering overwhelming defeat.

Slavery issues divided the Democratic party to an even greater degree than financial controversy had earlier. During the 1850's the Whigs remained a minority compared to the Democratic party as a whole, but they enjoyed a plurality status in relation to the two Democratic factions. Among themselves most Whigs concurred that nonagitation was the proper solution of slavery polemics. Problems arose, however, when it was necessary to appeal for Democratic support in the legislature to obtain the majority needed to elect a United States Senator. Would true Whiggery be violated least by leaning toward Benton freesoilism or toward the more Southern affinities of his opponents? As a party the Whigs could not answer this question, and they disbanded in 1855.

Microfilm \$4.50; Xerox \$16.00. 352 pages.

THE SOCIETY OF THE MUSLIM BROTHERS

(L. C. Card No. Mic 60-5024)

Richard Paul Mitchell, Ph.D.
Princeton University, 1960

This thesis deals with the history, organization and ideology of the Society of the Muslim Brothers. The history of the movement is preceded by a resume of the life of the founder, Hasan al-Banna. It is emphasized that Banna's youth evidenced a long involvement with numerous organizations concerned with morality and the regeneration of Islam and that he not only developed a strong sense of the practical but applied this quality to his effectively developing ability and sense of leadership.

The movement's humble beginnings among the workers of the Suez Canal Zone city of Isma'iliyah are traced through its early days in Cairo during which time the essential framework of the organization was established, and through World War II during which the organization's institutions were perfected and the Society experienced its first clashes with authority. The forces at work in the World War II are seen as important elements in the appearance, in the post-war period, of the Society in the center of the Egyptian political arena. That period showed a fundamental conflict between the two mass parties of Egypt -- the Muslim Brothers and the Wafd -- as they contested for political primacy. It showed also an initial harmony of purpose (in opposition to the Wafd) between the Society and the Palace which broke down in the wake of extensive violence in Egypt between 1946 and 1948. That violence is seen as a consequence of the disputes among competing political factions, disputes exacerbated by the passions aroused by the international frustration bred by Egypt's dispute with Britain and the Palestine question. The violence of the year 1948 in which the Brothers were especially prominent is shown to have culminated in the assassination by a Brother of prime minister Nuqrāshi and the consequent dissolution of the organization and the murder of its leader, Banna.

After a short period underground, the Society emerged with a new leader, and, following the army revolution of July 1952, a new importance, an importance which derived from a long clandestine association of some of the army officers with the Society. The period 1952 to 1954 is traced in detail -- from an initially happy phase between the two groups through the gradual embittering of relations which culminated in the attempted assassination of prime minister Nasir in October 1954. The historical part of the study ends with the hanging of six Brothers in December 1954 for that attempt.

The organization of the Society is treated next with emphasis on the hierarchy and formal chain of command in the central and field apparatus. Detailed treatment is accorded the devices used and institutions available in the Society for communication and indoctrination of the membership, and for effecting the Society's will.

The third section of the study treats the ideology of the Society. Attention is first focussed on the problem of Islam and Egypt as the Society saw it -- the destruction of the faith and the corruption of Society. The theoretical solution to that problem is treated next -- the return to the principles of Islam. The section ends with a description

of the practical activity and reform proposals for all areas of life by which the Society hoped to effect a truly Islamic order.

A concluding section attempts to assess the organization in the light of Egypt's recent political history and of Islamic modernism. It is noted that although much of the political violence for which they must take credit resulted from a widely shared sense of political frustration with ineffective parliamentary processes, the violence of the Brothers had the added Islamic dimension which created an intolerant measure of sectarianism. Its role among modern Islamic movements is similarly seen. Although sharing in some areas the relatively catholic Muhammad 'Abduh tradition, the Society also reflected the progressive change in the character of that movement to more rigidity and thus more intolerance. Finally, it is observed that the movement, although conservative in spirit and in quantitative membership, attracted as activists largely lay and urban types most of whom in varying degrees had already accepted the premises of modernization. That so many of these were men with no stake in society created the turbulence which characterized the movement of the Brothers.

Microfilm \$9.20; Xerox \$32.65. 725 pages.

NEHRU AND THE UNITED STATES 1947-1957

(L. C. Card No. Mic 60-4851)

Kalaiah Narasiah, Ph.D.
The University of North Carolina, 1960

Supervisor: Fletcher M. Green

This is a study of the relations of the United States and India under the premiership of Pandit Jawaharlal Nehru between 1947 and 1957. Before Nehru became Prime Minister of India he had had little direct contact with the United States. He had, however, studied American history, saw in her struggle for independence from England a parallel to the effort of the peoples of Southeast Asia to free themselves from European colonialism, and accepted the American concept of freedom, democracy, and constitutional government. President Franklin Delano Roosevelt's support of Dominion status for India greatly stimulated Nehru's interest in American history and Nehru was instrumental in the incorporation of many of the basic principles of the United States constitution into the Indian constitution and government.

The United States was the first great power with which India established diplomatic relations. India appointed a Muslim as Ambassador to the United States but John Foster Dulles, leader of the United States delegation in the United Nations, characterized India's government as Hindu. Dulles attacked India for voting with Russia on the issue of racial discrimination in South Africa, and charged that India was under the influence of Soviet Communism. The United States voted against India's proposal condemning racial discrimination. India protested to the Security Council of the United Nations that Pakistan had committed an aggression by invading Kashmir. The United States rejected India's complaint and supported Pakistan in her claim to Kashmir.

India's dire economic condition led Nehru to visit the United States in 1949 to seek economic aid. The United States displayed little interest in this matter but did wish to draw India into a military alliance against Communist China. No agreement could be reached; Nehru returned to India, and shortly thereafter India recognized China. Later, in 1951, Nehru appealed to the United States and a program for the sale of wheat to India was agreed upon. There were further conflicts of interests between the two countries over the Korean War, the Indo-China War, and the Goa problem. As India saw it the United States cast her lot with the colonial powers and the prestige of the United States declined. Largely due to the work of Chester Bowles friendly and cordial relations were maintained.

Relations between the two nations worsened under the Eisenhower administration and the Republican "New Look" policy for the Far East. India and her neighbors were caught in the conflict between the two power blocs led by the United States and Russia. Nehru formulated a more clearcut foreign policy known as The Five Principles or Panch Sheel. This policy was based on the mutual respect of the territory and sovereignty of all nations, nonaggression, noninterference in internal affairs, equality of mutual benefit, and peaceful coexistence. These ideas were accepted and incorporated into the agreements of the Bandung Conference. Nehru made democracy and peaceful coexistence the core of his foreign policy.

The United States and India had a common goal--world peace--but they differed in their views as to how to attain the goal. The former looked to military strength and alliances; the latter sought peace through nonalignment. Mutual confidence and cooperation of the two powers was an important factor in world peace. It is in this context that the development of friendly relations between India under the leadership of Nehru and the United States is important not only for the two countries but for the whole world.

Microfilm \$3.70; Xerox \$13.05. 288 pages.

THE FRENCH REVOLUTION IN CONTEMPORARY AMERICAN THOUGHT

(L. C. Card No. Mic 61-522)

Richard Schuyler Schadt, D.S.S.
Syracuse University, 1960

This is a study of the role of the French Revolution in contemporary American thought. It is based on an analysis of the magazines published from 1789 through 1800. These magazines have been made available recently on microfilm in the American Periodical Series. The magazines are a rich, and previously neglected, record of American thought in the 1790's. They contain numerous thoughtful essays and articles, many of which deal directly or indirectly with the French Revolution.

My primary attention has been directed to the impact of the French Revolution on American thought. Secondary attention has been devoted to public opinion of the Revolution. The initial American reaction was enthusiastic. Americans believed that the American and French Revolutions were intimately related. They thought that they were witnessing the beginning of a new era. Revolution would

sweep the world and free men everywhere. The events in France appeared to confirm the optimistic and humanitarian elements of the philosophy of the Enlightenment.

Interest in events in France waned between the fall of 1789 and the spring of 1792. As the armies of Austria and Prussia invaded France, American interest revived. French victories were celebrated at elaborate public banquets. The execution of Louis XVI provoked the first general denunciations of the Revolution in the American periodicals. Many writers, and probably a large part of the population, remained enthusiastic supporters of the Revolution until the disclosure of the XYZ Affair in 1797.

Anti-Revolutionary articles dominated the magazines after 1795. The American anti-Revolutionists charged that the French Revolution was anarchy. They bewailed the violence associated with many events in France. The attack on the Revolution was accompanied by articles of a typically Romantic character. Writers challenged the adequacy of reason and exalted passion and sentimentality. Utopianism was ridiculed and equality was declared to be absurd. Anti-Revolutionary writers reported the existence of Jacobin plots to plunge America into a bloody revolution.

The French Revolution was a vital topic in America because it dramatized the same conflict which animated the domestic political scene. Jeffersonian Republicans recognized the essential democratic nature of the Revolution and heartily endorsed it. Federalists denounced the Revolution on the same grounds. In the debate over the issues of the French Revolution American political party lines crystallized.

The XYZ Affair in 1797 set off a wave of popular indignation. Reports of Jacobin intrigues multiplied and a period of anti-Jacobin hysteria followed. The Alien and Sedition Acts were passed and an undeclared naval war began.

The popularity of the Federalist Party was undermined when John Adams decided to reopen negotiations with France. As the war hysteria subsided, new Republican magazines appeared to champion the cause of the French Revolution and democracy. The election of Thomas Jefferson to the presidency in 1800 constituted a popular vindication of the democratic ideals of the French Revolution.

Important changes occurred in American thought between 1789 and 1800. Many Americans of both parties were convinced that non-involvement in European affairs was the wisest basis for American foreign relations. Disillusionment with the course of events in France turned American attention to domestic affairs. America was declared to be the last example of a free and just government. The New World was to be a haven for the oppressed of the Old World. The shabby treatment accorded America by the European powers stimulated the development of American nationalism.

This study is intended to supplement previous studies based on other materials. It makes no claim to challenge the general conclusions of earlier works.

Microfilm \$3.20; Xerox \$11.05. 245 pages.

THE HISTORY OF THE AMERICAN COLONIZATION SOCIETY

(L. C. Card No. Mic 60-6792)

Philip John Staudenraus, Ph.D.
The University of Wisconsin, 1958

Supervisor: Professor William B. Hesseltine

The American Colonization Society, organized in 1817, brought together many men who believed that the "African" was an alien in the United States and a social blight that threatened the future of the nation. The parent society and its scores of state and local auxiliaries called for the voluntary emigration of all free Negroes to Africa. Though the Colonization Society established its own colony (Liberia) as a pilot study to show the practicability of the scheme, its real intention was to persuade the state and federal governments to underwrite and promote a far larger project. Around these precepts it built a large social movement distinguished by the endorsements of Thomas Jefferson, James Madison, John Marshall, Henry Clay, and many other well-known figures.

The Colonization Society belonged to the phalanx of "benevolent" societies that included the American Bible Society, American Tract Society, American Sunday School Society, American Temperance Union, and others. These associations held that social "evils"--such as immorality, vice, ignorance of the Bible, slavery, pauperism, and so forth--impoverished society and threatened the "general welfare." To remove or neutralize these "evils" would strengthen society and bless the men who thus shaped its destiny. Unlike the other "benevolent" or melioristic associations which depended on voluntary action, the Colonization Society insisted that the presence of the "African" in the United States was a national problem that deserved national funds as well as private charity. Though Congress was reluctant to adopt an African colonization scheme, President Monroe extended indirect aid in establishing Liberia, and various state legislatures gave token assistance. The Colonization Society tried to soften congressional opposition by arguing that colonization would stifle the slave trade and open the door to African commerce. It appealed to missionary-minded Americans, saying colonization would civilize the "dark continent." It declared that removal of the free Negro would hasten the process of manumission and in time accomplish the total eradication of slavery.

Opposition to the American Colonization Society came from a large portion of the free Negro population in eastern cities. The outspoken antislavery editor William Lloyd Garrison voiced their hatred of colonization, charging it was a scheme by greedy slaveholders to strengthen the chains of slavery by removing the free Negro. Colonizationists and antislavery men engaged in a long and violent public controversy. Meanwhile, the society over-extended itself in transporting emigrants and giving aid to the frail colony. After 1833, a large debt burdened its work and besmirched its credit rating. Many merchants and "benevolent" men accepted the society's indebtedness as evidence of mismanagement and waste. Simultaneously, the society suffered internal dissensions which deprived it of its chief auxiliaries. The Maryland auxiliary, with state support, established an independent colony that rivalled Liberia. The defection of important auxiliaries and prominent contributors further crippled the society's

finances and reduced the society's ability to pay its debt. After 1837, the society's management was drastically altered, the society's constitution revised to bring back errant auxiliaries, and the colony remodeled and later turned loose.

The society survived, but the movement died. Though colonization continued to be the "popular" solution to the race question, the society never recovered its strength and prestige. The Civil War brought new opportunities for a government-sponsored colonization project, but the Colonization Society did not enjoy a renaissance. Instead, President Lincoln looked to Central America and Haiti for possible colonization sites. These proved unworkable, and the Fourteenth Amendment granting citizenship to the freedmen decided that the solution to the race question was not to be removal.

Microfilm \$5.35; Xerox \$18.90. 417 pages.

THE DIPLOMACY
OF THE IMMIGRATION ISSUE:
A STUDY IN
JAPANESE-AMERICAN RELATIONS,
1894-1941.

(L. C. Card No. Mic 60-6330)

John Roger Stemen, Ph.D.
Indiana University, 1960

The present study is a diplomatic history of the immigration issue between Japan and the United States. The issue involved the questions of how Japanese immigration to the United States was to be regulated and how Japanese residents of the United States were to be treated in regard to civil rights, rights of land ownership, and other important rights and privileges.

The diplomatic history of the immigration issue is largely an account of actions taken by the Japanese Government on behalf of Japanese subjects who were deprived of or denied real or potential rights and privileges by state or local governments, agencies of the federal government, or by Congress and the Supreme Court of the United States. Events which brought such actions by the Japanese Government included the school segregation order of the San Francisco Board of Education in 1906, the California alien land legislation of 1913 and 1920, Supreme Court decisions on Japanese eligibility for naturalization and on legality of the alien land legislation in 1922 and 1923, and the prohibition of Japanese immigration in the United States Immigration Act of 1924. The Japanese Government also protested a number of other incidents which it felt to be discriminatory.

The strength of anti-Japanese sentiment on the West Coast of the United States prevented the Department of State from exercising a free hand in dealing with the immigration issue, and forced the negotiation of a somewhat unsatisfactory compromise settlement, the Gentlemen's Agreement, in 1907 and 1908. In the Gentlemen's Agreement, an executive arrangement, the Japanese Government promised voluntarily to refuse passports for the United States to laborers; while the United States Government agreed to do all it could to prevent legislation discriminating against Japanese immigrants. Japanese were extremely sensitive to any measures discriminating against their compatriots, and were willing to give up any

real emigration to the United States for the sake of maintaining the appearance of equality for Japanese immigrants. Hence, the Immigration Act of 1924, in which Europeans were granted the privilege to immigrate, which was denied to Japanese, was a blow to Japanese pride, and caused many Japanese to feel hostile toward the United States.

The diplomatic history of the immigration issue shows the failure of the United States Government to find a solution satisfactory to both the Japanese Government and the anti-Japanese groups in the United States. It also reveals the importance of the issue as a sentimental matter to many Japanese. Although the immigration issue did not contribute directly to causes of war between the two countries, it did damage feelings and help to undermine pro-American sentiment in Japan. The unfortunate outcome of the immigration issue raises the question of whether the United States might not have been able to find a solution which could have avoided discrimination against Japanese without sacrificing the economic or social interests of American citizens.

Microfilm \$4.55; Xerox \$16.00. 355 pages.

MILITARY INTERVENTION
AND CIVILIAN REACTION IN CHILE,
1924-1936.

(L. C. Card No. Mic 60-6682)

Terence Stephen Tarr, Ph.D.
The University of Florida, 1960

Chile is called a model Latin American democratic nation, for she has a long history of civilian government, few revolutions, and little military interference in political matters. The two notable exceptions in recent Chilean history were the Revolution of 1891 and the period 1924-1932. During this latter period, furthermore, the military revolutions nearly succeeded in toppling the entire democratic structure of the country. The Ibáñez administration from 1927-1932 and the 100-day Socialist Republic were two of the more notable administrations established or supported by the military; but neither of them lasted, and the Chilean people witnessed a series of governments, none of which was able to remain in the Moneda for its legal term. Abruptly in 1932, however, with the election of Arturo Alessandri to the presidency for a second time, the situation changed as the military returned to its labors and promised to remain out of politics. Part of the answer for this sudden change in attitude was due to the influence of officers who wanted to return the administration of the nation to the civilians and to return the military to its rightful duties. But only when the civilians organized a special militarized civil militia was the government able to return the country to real stability. The Republican Militia, this civilian organization, was the answer formulated by the Chileans to end military influence in political matters.

The militia existed for four years, voluntarily dissolving itself in 1936. During this period the militia filled an important role in Alessandri's plans for the reconstruction of the nation, and its mere existence had repercussion in political military circles as well. Even though the militia was avowedly nonpolitical, it could not remain out of political debates. The parties of the left called it fascistic, the parties of the right faithfully supported it,

the moderates tried to side step the issue, and the Nazi party, aiding it at the first, later denounced it. The military greeted the militia with mixed reactions as the navy and the police publicly approved the militia, while the army refused to commit itself. The militia was, therefore, a controversial issue, and it was nearly impossible for anyone to remain neutral about it. As a result of Alessandri's refusal to ask for the militia's disbandment and his increasing reliance on the right wing parties, the moderates and left wing groups were driven into each other's arms. The result of this rapprochement was the creation of the Chilean Popular Front.

Alessandri publicly gave the militia his aid as he had

no other alternative. The political situation in 1932 was chaotic, and the militia appeared as the only force willing to aid the government and in return to ask for nothing. His action of aiding the militia, therefore, was based on the situation at the time, as the militia appeared as the only force interested in restoring tranquility to the shattered nation. Even though the militia was not called upon to defend the constitutional government, it served as a warning to those who plotted and planned. In this manner the militia played an important role in recent Chilean history, for it aided in re-establishing tranquility and law to a country destroyed by eight years of political unrest.

Microfilm \$3.95; Xerox \$13.95. 308 pages.

HOME ECONOMICS

THE RELATION BETWEEN ROLE-STANDPOINT AND LEVEL OF MARITAL ADJUSTMENT

(L. C. Card No. Mic 61-42)

Daniel Franklin Hobbs, Jr., Ph.D.
The Pennsylvania State University, 1960

The objective of the present study was to investigate the relation between role-standpoint and level of marital adjustment. Role-standpoint was defined as the point of view or perspective from which a person surveys or evaluates a social situation and by which he orients the behavior or attitude of self relative to that situation; thus conceived, it is a relative position or an attitudinal set. Marital adjustment was defined as an adaptation between husband and wife which results in companionship, agreement on basic values, affectional intimacy, accommodation, and euphoria.

Data were collected by means of a questionnaire which had three sections. The first part of the questionnaire related to data which described the subjects. The second part of the questionnaire contained 22 items, each of which described a situation in which a husband and wife had conflicting viewpoints. Each item was followed by four alternatives, two of which agreed with the husband's viewpoint, two of which agreed with the wife's viewpoint; subjects were to select the alternative which most closely agreed with the way they thought they might resolve the conflict. Persons who scored above the mean possible role-standpoint score were classified as altruistic; those who scored below the mean possible score were classified as egoistic. The third part of the questionnaire consisted of 26 items relating to marital adjustment. Subjects were requested to rate themselves on each item; the higher the score, the better the marital adjustment.

Parents of college freshmen were the subjects of the present study. There were 95 males and 98 females, 63 of whom were husband-wife pairs.

As predicted, both sexes were more altruistic than egoistic in their responses to the contrived role-conflict situations, and women were more altruistic than men. Also as predicted, there were some types of situations to which the majority of persons of each sex responded egoistically; men typically adopted egoistic role-standpoints relative to 10 of the 22 items and women adopted egoistic role-standpoints relative to four of the 22 items. Over 25

per cent of the subjects of both sexes adopted egoistic viewpoints to almost one-third of the items. Consonant with the prediction, moderate positive correlation coefficients were obtained between role-standpoint and level of marital adjustment. Findings did not support the fourth hypothesis which predicted that moderate rather than extreme role-standpoint scores would be characteristic of persons who reported the highest levels of marital adjustment.

The level of marital adjustment was highest for cases in which both spouses ranked above the mean possible role-standpoint score, i.e., when both persons indicated a willingness to adopt the viewpoint of the other in order to resolve the conflict. The most frequent pattern of conflict resolution was the one in which the husband adopted an egoistic viewpoint and the wife adopted an altruistic viewpoint; the least frequent pattern was the one in which both spouses adopted egoistic viewpoints. The mean marital adjustment score for subjects of the present study was 80 per cent of the total possible score.

It was concluded that persons of both sexes expected the wife to adopt the husband's viewpoint more frequently than they expected the husband to adopt the wife's viewpoint as a pattern for resolving the contrived conflict situations. Apparently marital adjustment was facilitated most by a willingness of both husband and wife to adopt the viewpoint of the other as a means of resolving the conflicts in viewpoint.

The study has significance because of the ages of the subjects who were studied and because of the possibilities of future use of the instrument in research and marriage counseling. Microfilm \$2.75; Xerox \$5.20. 101 pages.

THE Q-SORT: AN EVALUATION OF ITS EFFECTIVENESS IN ASSESSING CERTAIN ASPECTS OF SELF-DISCIPLINE AMONG HIGH SCHOOL GIRLS.

(L. C. Card No. Mic 61-45)

Julia Kilpatrick, Ed.D.
The Pennsylvania State University, 1960

This study was concerned with the development, refinement and use of an evaluation device designed to help a

high-school girl and her homemaking teacher determine areas of strength in the girl's self-discipline.

Answers were sought to four major questions:

- (1) Can a Q-sort be devised to delineate in a valid way certain intangible aspects of the self-discipline of a high-school girl?
- (2) Will the Q-sort constructed for this study give a reliable picture when used by the girl?
- (3) Will peers tend to use the instrument in such a way that it will give a picture similar to the one obtained when used by the girl?
- (4) Will the opinion of her self-discipline that a girl reveals through the Q-sort be consistent with adult opinion?

The four segments of behavior chosen for this study were (1) Becoming More Neat and Orderly, (2) Becoming More Trustworthy and Dependable, (3) Starting Things on My Own, and (4) Finishing What I Start. These categories were determined during the summer of 1957 from replies to questions asked at the Pennsylvania State University of fifteen experienced high-school homemaking teachers enrolled in a course in Evaluation in Family Life Education.

Eighty statements self descriptive of a high-school girl were then developed from a list prepared by the investigator with her doctoral committee serving as a jury. The sort was balanced by having ten statements indicating the practice of good self-discipline and ten statements indicating the lack of self-discipline for each of the categories enumerated in the paragraph above.

The sorts were administered by asking the student to sort the cards into a quasi-normal distribution. Records of the sorting were collected from three hundred students in homemaking classes in seven Illinois high schools which cooperate with Eastern Illinois University in the off-campus student teaching program. These students were distributed as follows:

127 in Grade 9
88 in Grade 10
52 in Grade 11
33 in Grade 12

Although a jury had been used in constructing a valid device, a further check of the validity was made by item analyses. In addition it should be stated that the Q-sort purports to measure perception and the best available measure of this perception is reliability. In this study the reliability of the sort was determined by the test-retest method. One hundred girls were asked to describe themselves a second time by resorting the cards after an interval of seven to fourteen days.

In order to determine whether friends would evaluate a girl as she evaluated herself, each of one hundred girls was asked to name three friends who she thought could sort the cards to describe her accurately. An average of the scores from the sorts of the three friends was used for the comparisons.

A check sheet of forty statements was adapted from the Q-sort and an adult closely associated with each girl was asked to check the sheet as she thought it described the girl's self-discipline. These scores were compared with the girl's scores on the same statements in her self-sort. This sample of adults consisted of eighty mothers, one aunt and four from teachers who completed 100 check sheets.

The findings in this study indicated that on item analyses all statements had I.R. scores which were positive. Possible range of scores was from - 72 to 72. The observed range of scores was from - 44 to 72 with a mean score of 24.6. The reliability of the sort as determined by sort-resort and applying the Pearson product-moment formula was an $r = .700$ and by a Kuder-Richardson formula was an $\bar{r} = .936$.

Both peers and adults tended to give higher scores than the individuals gave themselves. As determined by the Pearson product-moment formula the reliability between scores given by peers and scores the girls gave themselves was an $r = .440$. Reliability between scores given by the adults and scores the girls gave themselves was an $r = .210$.

The Q-sort in its present form could be used for group counseling, for indicating areas of improvement in self-discipline and for suggesting possible learning activities and home experiences.

Microfilm \$2.75; Xerox \$6.20. 128 pages.

JOURNALISM

A STUDY OF THE POTENTIAL CONTRIBUTION OF BROADCASTING TO THE DEVELOPMENT OF UGANDA

(L. C. Card No. Mic 61-513)

Richard Green Katongole, Ph.D.
Syracuse University, 1960

This study, designed to determine and describe the potential contribution of broadcasting to the development of Uganda, was carried out in two major parts.

The first part was basically exploratory. We wished to find the literature available on the subject of mass com-

munication in underdeveloped areas, including Uganda; the extent to which the existing communication media have assisted in the development of Uganda, and the economic, cultural and historical basis for radio's assistance in the development of Uganda.

In the second half of the study, the object has been to analyze, in the light of the needs of most people in Uganda, radio's potential role in the future development of the country.

The first step that was taken here was to formulate a program policy for the service which would guide future program planners. It was suggested this program policy should constitute the following points:

- 1) To raise the standard of living through programs

covering such subjects as agriculture, health and sanitation, and other related educational or public service programs directed to men, women or children.

2) To encourage participation and interest in civic and governmental affairs.

3) To broaden people's outlook both on their own country and on the world through broadcasting different types of news.

4) To encourage interest in, and preservation of African cultures and institutions.

5) To provide the best in entertainment programs.

6) To supplement in-school education.

The next step was to examine in detail the types of programs which should be aired by the Uganda Broadcasting Service under the different points outlined above. This discussion of programming aspects was accompanied by a suggested program schedule for a full week.

The study also stressed the fact that the biggest single problem in the development of an effective broadcasting system in Uganda will be the training of personnel. It was thought unlikely that the need would arise in a small country like Uganda for the training of a great number of broadcasters. But it was recommended that Uganda undertake a program of training selected broadcasters in England and the United States. It was also suggested that an in-service training program be developed for the rest of the broadcasting personnel. The chapter on "training broadcasters" written with special consideration of the requirements of broadcasters in Uganda was intended to be a guide on writing for radio, announcing, and directing; and to provide a general knowledge of certain technical aspects of broadcasting.

Apart from other practices, which this study advises should be followed for the improvement of various aspects of Uganda radio, the following constitute a summary of some of the major recommendations:

1) The broadcast time should be expanded from 6 3/4 hours--the maximum daily broadcast time at present--to 18 hours daily, in order to facilitate more time for the much-needed educational programs.

2) The present six African transmissions must be cut down to only three to reduce the problems of programming for a multiplicity of languages.

3) In order to expedite the development of English as the country's common language, "English by Radio" programs must be a regular feature on Uganda radio.

4) Government must participate actively in the production of some educational programs.

5) Periodical audience studies must be made to feel out needs and reactions of listeners.

Microfilm \$3.45; Xerox \$12.15. 266 pages.

C. K. McCLATCHY
AND THE SACRAMENTO BEE,
1883-1936.

(L. C. Card No. Mic 61-523)

Bernard A. Shepard, Ph.D.
Syracuse University, 1960

Supervisor: George L. Bird

Charles Kenny (C. K.) McClatchy served as a newspaper editor from 1883 to 1936. This dissertation is an

assessment of his journalistic career, determined through reading and analysis of his numerous editorials and columns in *The Sacramento Bee* and in two other papers added to McClatchy holdings during his long tenure. Effort was made to show the scope of his writing, his attitudes toward major issues of his time and, to a greater degree, the campaigns which he initiated and directed. The work also includes reference to McClatchy's concepts of press responsibility.

To accomplish the objective of the dissertation, approximately 36,000 individual editorials and columns were investigated. Files of newspapers were made available in the libraries of *The Sacramento Bee*, *The Fresno Bee*, and in the public libraries of the city of Sacramento and the state of California. In order to augment appreciation of the editorial content, background reading was done in the varied subjects about which McClatchy commented. The dissertation is divided into twelve chapters designed to portray the editor's attitudes and positions on major questions in diversified fields, among them politics, journalism, race relations, labor, business and industry, and foreign relations.

The author concludes that, generally, C. K. McClatchy was an independent editor, free from affiliation with specific political party or special class, except when his own attitudes coincided with those of the particular group. He was, in essence, a reformer who believed a conscientious editor must crusade in the public interest. McClatchy waged intensive campaigns against monopoly, favored stringent regulation on Big Business, and backed measures to lessen the plight of the laborer. He exposed corruption in government and became an ardent supporter of the progressive movement led by such men as Hiram W. Johnson, Theodore Roosevelt, and Robert M. La Follette.

McClatchy was an uncompromising editor, seldom wavering in the course of even an unsuccessful campaign. Among his most vigorous campaigns were the following: government ownership of railroads and public utilities, rigid enforcement of anti-trust laws, government or public development of power sites and reclamation projects, conservation of natural resources, and compulsory arbitration in management-labor disputes. He also campaigned for the direct election of United States Senator, president and vice-president; favored such progressive reforms as the initiative, referendum and recall; opposed the prohibition amendment and supported the principle of woman suffrage.

In the period following the first World War, McClatchy intensified his isolationism, opposing vehemently American recognition of the League of Nations and the World Court. He had little faith in disarmament conferences and urged strong defenses as a deterrent to foreign aggression.

In other matters, McClatchy was a leader in the anti-Asiatic movement in California which culminated in exclusion laws aimed primarily against the Chinese and Japanese. On the other hand, he urged more equality for other nationality groups in America's immigration laws.

McClatchy was seldom quiet editorially. He was a prolific writer who took specific stands on controversial issues, championing what he believed to be for the general welfare. He developed a reputation as an unyielding and crusading editor, unafraid of opposition. A high point in his career as editor came in 1935, when *The Sacramento Bee* was awarded a Pulitzer Prize for meritorious public service. Microfilm \$4.25; Xerox \$15.10. 331 pages.

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

COSMIC SYMBOLISM IN PARADISE LOST

(L. C. Card No. Mic 60-6144)

Jack Dillard Ashley, Ph.D.
Vanderbilt University, 1960

Supervisor: Professor Claude L. Finney

Symbolism, a major poetic technique, must be understood in its traditional meanings and usages. The first and second chapters of this study attempt to explore that tradition. Chapter I is an investigation of the philosophic background. Milton is an ontological monist and continues the Christian Neoplatonic tradition developed and supported by Origin, Imablichus, Proclus, Dionysius the Areopagite, John Scotus Erigena, Alain de Lille, Duns Scotus, Paracelsus, and Boehme. Certain dualists -- Plato, Philo, Plotinus, Augustine, and Ficino -- are included for comparison.

Chapter II is an investigation of Milton's literary milieu. Although Spenser, Shakespeare, and Donne are ontological dualists, they share with Milton the technique of cosmic symbolism. Such works as *Muiopotmos*, *Richard II*, the *First Anniversary*, and *Comus* are similar in technique.

Chapter III is a formulation of the general symbolic pattern of *Paradise Lost*. This pattern is based on the traditional characteristics of cosmic symbolism: a correspondence among the various levels of existence, with the poetic image taken from the macrocosm, linked and extended throughout the work, and existing ultimately as an instrument of theocentric mysticism. Milton also uses the device as a psychological image of the microcosm, a descriptive image of the macrocosm, and a means of surveying the cosmic unity of God's creation. As examples of these features, the symbols of the storm, sea, plant, stairway, and music are traced throughout the poem.

The remaining units investigate the functional capacity of cosmic symbolism by analyzing three symbols. It is a structural device in Raphael's discourse which is based on symbolic parallelism. Chapter IV is an analysis of this parallelism. The war in Heaven, a symbol of partial destruction, is balanced against the creation of the world. The balance is further considered to be parallel action of the microcosmic battle of passion and reason within Adam and the re-creation of fallen man.

Chapter V is an analysis of the Garden of Eden as the principle of symbolic focus. *Paradise* is central in terms of imagery, dramatic struggle, topography, and ideology. Furthermore the garden may be interpreted as Milton's poetic representation of the golden age of prelapsarian life and Ficino's realm of Nature, the seminary of all earthly forms. The garden as a symbol depends upon cosmic correspondence and shows an analogous resemblance with the counterfeit cosmos of Hell, with Heaven, and with the universe. Allegorically the garden is the world; morally

it is the mind of man; mystically it is the manifested mind of God.

Chapter VI is an analysis of the antithesis of light and darkness as the dominant symbol of *Paradise Lost*. The antithesis is the basis of the topographical scheme of the poem. Hell is utter darkness inhabited by devils whose minds are darkened. Chaos is middle darkness and is symbolic of prime matter out of which cosmos is created. Heaven is the place of light inhabited by God who is light and the angels who are sons of light. Man and his universe are symbolized by both light and darkness. The antithesis thus symbolizes good and evil, reason and passion, and on the highest level the creative power of God operating on matter. Finally the fervor of the symbol is the result of Milton's blindness which adds a psychological level.

Symbolism is perhaps the only technique by which a poet may completely express his vision of life. By such an analysis of *Paradise Lost*, one achieves an apprehension not only of a poetic technique but also of the ways of the poetic imagination and the content of a revered philosophic tradition. Method, man, and material -- the three are inseparably yoked.

Microfilm \$5.50; Xerox \$19.60. 432 pages.

EIGHTEENTH CENTURY FRENCH TRANSLATIONS AND ADAPTATIONS OF SHAKESPEARE

(L. C. Card No. Mic 60-6537)

Helen Elphinstone Brooks, Ph.D.
Northwestern University, 1960

The mania for things English which developed in the second half of the eighteenth century in France included, as both cause and effect, a passionate admiration for Shakespeare. But this Shakespeare whom the French welcomed was so changed by his translators and adaptors as to be, to English readers, almost unrecognizable.

Pierre Antoine LaPlace's *Le Théâtre Anglois* -- eight volumes (1745-1749), of which the first four are devoted to Shakespeare -- was the first, and for thirty years the only, edition of Shakespeare in French translation. The preface, a "Discours sur le Théâtre Anglois," -- almost entirely a discussion of Shakespeare -- shows LaPlace to be, if not in terms of eighteenth century English criticism, at least for his time in France, an open-minded liberal in matters of drama, and a propagandist for Shakespeare. His obvious enthusiasm, devotion to Shakespeare, and the ingenuity with which he presents his case are outstanding features of the "Discours." Although LaPlace knew that the cultivated French theatre-goer demanded novelty yet condemned the least relapse from the exactitude of Racinian classicism in form, diction, subject matter, or decorum, he nevertheless undertook to persuade this audience that Shakespeare's principles and

practice, so different in every particular from Racine's, were both justifiable and preferable. The "Discours," which has never been republished or edited, and which critics have largely neglected, is one of the important documents in the history of Shakespeare in France.

LaPlace redefines drama with particular emphasis on the terms imitation, action, necessity and probability in arguments which reflect the philosophic spirit of the Enlightenment and the spirit of progress. LaPlace suggests that the French reader's limited view may in fact be, not proper but provincial. The essay shows a kinship with the *Poetics* of Aristotle. LaPlace does not take the contemporary attitude toward the unities. On this subject, as on several others, LaPlace seems to antedate the arguments of Dr. Johnson.

LaPlace translated ten plays and summarized the rest. The translations do not reflect the liberality of the "Discours." By translating parts of the plays and summarizing others, LaPlace cut the plays so as to remove most of their violence, brilliance of metaphor, and wide display of characterization. LaPlace's method, its results, and its relationship to the "Discours" are studied in *Hamlet*, *Romeo and Juliet*, *King Lear*, and *Macbeth*.

Jean-Francois Ducis, relying on LaPlace's translation and later on that of LeTourneur, adapted *Hamlet*, 1769, *Romeo and Juliet*, 1772, *King Lear*, 1783, *Macbeth*, 1784, *King John*, 1791, and *Othello*, 1792. All except *King John* were extraordinarily successful on the stage. In addition to regularizing Shakespeare as LaPlace had done, Ducis added elements from heroic drama. Most striking however, is Ducis's reworking of Shakespeare's plots to enhance the pathetic and terrible and to make the plays almost melodramas. These changes are studied in *Hamlet*, *Romeo and Juliet*, *King Lear* and *Macbeth*.

Pierre Félicien LeTourneur's translation of all thirty-six plays, Shakespeare, traduit de l'Anglois -- twenty volumes (1776-1782) -- though a more full and accurate work than LaPlace's, still is bowdlerized and sentimentalized. Perhaps the most interesting part of LeTourneur's work is, as with LaPlace, the "Discours" at the head of the edition. Purportedly extracted from the prefaces of all English editors before LeTourneur, it is almost entirely a translation of Dr. Johnson's "Preface to Shakespeare" combined with several crucial passages lifted almost verbatim from LaPlace's "Discours." Since LaPlace antedated Johnson by twenty years, the juxtaposition bears out the estimate of the liberal position of LaPlace.

Microfilm \$2.75; Xerox \$8.80. 193 pages.

THE REPUTATION OF JOHN DONNE
IN ENGLAND FROM 1600 TO 1832:
A STUDY IN THE HISTORY
OF LITERARY CRITICISM.

(L. C. Card No. Mic 61-292)

Robert Armistead Bryan, Ph.D.
University of Kentucky, 1956

Director: Dr. Thomas B. Stroup

Until 1633, Donne's literary reputation was built largely upon his satires, and several elegies, verse letters and love

lyrics, poems which were given particularized evaluation only by William Drummond and Ben Jonson. The sympathetic evaluations of Donne's writings accorded by fifteen elegists in the 1633 and 1635 editions of his poetry marked the high point in his literary reputation for the seventeenth and eighteenth centuries. Thomas Carew, whose elegy contained particular praise for Donne's original poetic vocabulary, his far-reaching wit, his psychological insights, and his passionate feeling, was the most representative, and perhaps the most perceptive, of those elegists.

Between 1633 and 1700 Donne's reputation gradually declined. The selections of commonplace book owners reveals that those readers--who were probably representative of the general reading public--paid special attention to his relatively simply stated poetry which contained a high degree of comedy. But fewer favorable evaluations of his writings appeared; and, in some critics' comments, a pattern of distrust evolved regarding Donne's metrical irregularities and the poetic validity of his frequently used academic metaphors. Dryden praised Donne's wit, but he was particularly unsympathetic towards Donne's metrical heterodoxy and his use of abstruse learning in love poetry. And Walton's sympathetic biography of Donne emphasized his devotion, erudition, and eloquence as a cleric almost to the exclusion of his secular poetry.

Alexander Pope and Samuel Johnson figured importantly in Donne's eighteenth-century reputation. Pope's re-versification of two of Donne's satires was a significant development in the history of Donne's reputation. While retaining much of Donne's language, Pope gave smoothness and regular cadence to Donne's poems. Those re-versifications were used repeatedly by later critics to demonstrate the irregularity and consequent barbarity of Donne's metrical patterns. Johnson censured four aspects of Donne's poetry: metaphysical wit was not based on empirical data and therefore became too involved with abstract concepts and speculations; the use of the academic metaphor in poetry detracted from the poem's legitimate purpose; Donne's poetic diction was too blunt and harsh; and his metrics were dissonant and confusing.

In general, most of the other eighteenth-century critics attacked the same four aspects of Donne's writings that Johnson found objectionable. Based mainly upon British empiricism which stressed the validity of sensory data and which tended to avoid suprasensible bases for speculation, the concept of judgment became an important criterion in evaluating wit in poetry. Hence Donne's wit, based largely upon his metaphysical speculations and his prodigious reach of metaphor, became suspect; and while granted by critics a great "fancy," he was classified as a minor poet because his judgment seemed deficient.

During the early nineteenth century, the attitudes towards Donne illustrate the development of conflicting aesthetic principles. Relatively few critics praised his works in detail; and many, following eighteenth-century critical precepts, generally condemned his writings. Yet he achieved a notable degree of favor among certain critics in the early nineteenth century who were well-known for their rejection of or evolution from literary traditions of their predecessors. Five "new" characteristics of criticism emerge in the new appreciation of Donne: (1) criticism in general had become more relativistic; (2) continuators of eighteenth-century formalism failed to withstand the development of new precepts

observable in Coleridge's criticism and in Wordsworth's poetry; (3) the disappearance of the old dichotomy of wit again permitted the poet to be startling and original; (4) the re-emergence of the organic function of rhetoric allowed the poet to be boldly elaborative without being thought pretentious; (5) the re-evaluation of the function of metre suggested a more tolerant view towards Donne's metrical experimentation. This "new" criticism was the root of the late nineteenth- and early twentieth-century revival of Donne.

Microfilm \$4.45; Xerox \$15.75. 346 pages.

**TWO INTERPRETERS OF GALICIA:
ROSALÍA DE CASTRO AND
EMILIA PARDO BAZÁN.**

(L. C. Card No. Mic 60-6173)

Matilda Contreras, Ph.D.
University of Pittsburgh, 1960

Spain, like other countries of the world, is made up of political divisions. Unlike these countries, these political divisions have never fused into a strong national state. Her regions, accustomed to political and cultural autonomy, have attempted to conserve their regionalism through the preservation of their speech, their folklore, and their literature. Spain is thus secondary to her regions.

Galicia, like the other regions of Spain, has remained immersed in her regional way of life living from the fruits of the past and building on her own cultural resources giving nothing and taking very little from the rest of Spain.

To talk about Galicia is to talk about the peasant. Rosalía de Castro, a Galician, aware of the disdain that greeted any mention of her region, cognizant of the mockery of the hard-working peasant and his dialect through her verses written in the popular language of the aldeano, expressed the Gallego's love for his region and his pride in the menial work that bound him to its soil. By identifying herself with the peasant, she became the voice of all that Galicia stands for.

Emilia Pardo Bazán also a Galician, through her regional novels and tales, wrote about the Gallego as a type, concentrating her ability as a writer on detailed facts that describe the peasant as the representative of Galicia. Her use of the dialect is for the purpose of accentuating her description of the Galician peasant. Galicia as a region, the Gallego as a peasant, and Gallego as a dialect, are described in a realistic manner by Emilia Pardo Bazán to effect her purpose.

Both succeeded in presenting a true picture of Galicia: Rosalía de Castro, subjectively, as the voice of the spirit of the peasant; Emilia Pardo Bazán, objectively, narrating and relating what she had observed and studied.

Microfilm \$2.75; Xerox \$4.20. 78 pages.

**STAY MY GRIEF
AND OTHER STORIES**

(L. C. Card No. Mic 60-5647)

Richard Cortez Day, Ph.D.
State University of Iowa, 1960

Chairman: Professor Paul Engle

Although these stories are bound as a group, there is no central purpose unifying them. They deal with characters in various settings and in differing social and economic circumstances; and each fictional character, as each character in life, is possessed of and by his own psychological being. Each story attempts to be an artistic whole, depending for its effect upon the strength and ordering of its own elements.

"Stay My Grief" deals with the relationship between grief immediately experienced and grief whose edges have been somewhat dulled by time. Alfred Clinton, age thirty-four, is suddenly bereaved of his wife, Nancy, who has been killed in an automobile accident. For the next few hours, all of the routine occurrences of daily life take on an unbearable significance for him. Doramae Todd, a widow of thirty-seven years standing, finds her grief rekindled by what has happened to her friends, the Clintons. Through this experience, she loses her wish to die.

The hero of "Quinito's Story," Quinito Ramirez, is faced with the dilemma of having a huge desire for fame and importance, while having at the same time no means of satisfying it. While trying to steal some money in order to leave his native town of Teluasco, Mexico, he inadvertently kills a man and is forced to flee empty-handed and fated to die.

In "Run, Papphos," a mentally upset man, whose past continually impinges upon his present, learns of a murder about to be committed. In a similar situation in the past he failed to prevent the killing, and in the present, after an all-out effort, he fails again. He returns to his home to face psychological punishment for his double failure.

"Malaise" is the story of George Pelham, a middle-class man whose wife has had a nervous breakdown. Her sickness is something that can be treated by psychologists; his isn't. He is sick with boredom; the purpose is gone from his life. Ironically, he doesn't realize this, except when he is awakened by a recurring guilt dream.

"The Tragical History of Gavin Randall" is a comedy dealing with man's desire to be totally free. Gavin has this desire, but differs from most men in that he acts upon it. He quits his job, divorces his wife and travels to California to live as a sort of frenetic hermit.

Microfilm \$2.90; Xerox \$10.15. 224 pages.

**THE PERSPICUOUS AND THE SUBLIME:
A HISTORICAL STUDY OF
THE LANGUAGE OF POPE'S ILIAD.**

(L. C. Card No. Mic 61-278)

Richard Clarence Gustafson, Ph.D.
University of Kansas, 1960

In the early eighteenth century, English had no stature as a language in which great literature should be written

and preserved. Each conscientious writer felt the duty to give more permanence to the language. This duty was most compelling to the writer or translator of an epic because the epic was the most noble of forms and with the most hope of survival. The theory of translation of the day demanded that the translator be judged more on his contribution to his own language than on literal fidelity to his author. In translation, then, is the surest place to look for the practical techniques by which poets attempted to dignify the language. Among Augustan writers, Pope appears as professedly dedicated to exalting the language, and emphatically so in his translation of the *Iliad*.

In the critical jargon of the Augustans, the language of the epic should attain stature through two qualities, the perspicuous and the sublime. The language should have colloquial ease and it should at the same time be elevated sufficiently from prose so that it attains the identity of poetry. This dissertation attempts to delineate the major techniques by which Pope strove for the perspicuous and the sublime.

Chapter II examines the rhetoric of Pope's translation because above all compositional units, Pope was most impressed by Homer's speeches. It is found that Pope organizes Homer's speeches within the bounds of Renaissance rhetoric, that he introduces moral issues not in Homer, and that he allegorizes characters. Both the perspicuous and the sublime govern these modifications.

The dialectic of forming objections to the style and then investigating them operates in Chapters III and IV.

Because inversions might defeat the hope for the perspicuous, inversions are considered in Chapter III. The investigation reveals that most of the inversions operate to make firm conclusions for lines and verse paragraphs, and to make the characteristic figures of Pope's style. In context, such inversions create emphasis for the sake of greater clarity. Also, these inversions maintain rules for the sublime as laid down by Aristotle and Longinus.

In Chapter IV the rarest usages are considered and found to be either acceptable or debateable in Pope's own day. Some are found which are parallels to classical grammar, and which might reasonably have been introduced to attain the sublime.

Another approach is used for Chapter V, in which the most native elements are considered. It is found that Pope borrows heavily from his forbears in native heroic poems and ballads. One such borrowing is the alliterated ballad epithet. Then the prosody of Pope's line is examined and compared with samples of prosody from Homer, Milton, and Old English. Pope's line is structured more like the Old English line than like any other.

The conclusion summarizes the techniques by which the perspicuous and the sublime appear in Pope's *Iliad*. Then the evidence and the conclusions of this analysis are used as a support for the contention that Homer's *Iliad* might have been composed in writing rather than orally.

Microfilm \$2.75; Xerox \$7.40. 158 pages.

WALTER SCOTT AND GERMANY: A STUDY IN LITERARY CROSS-CURRENTS.

(L. C. Card No. Mic 61-255)

Paul M. Ochojski, Ph.D.
Columbia University, 1960

This study is a collation and re-appraisal of the large body of work that has been done piecemeal and in varying degrees of accuracy on the relations of Walter Scott to German literature. It was felt that a synthesis of this scattered material, giving for the first time a continuous picture of this relationship, would be a worthwhile contribution to the history of Anglo-German literary relations.

Scott's interest in German literature was first stimulated by Mackenzie's lecture on the German drama in Edinburgh, April 21, 1788. During the winters of 1792-93 and 1793-94, Scott was a member of a class studying German. In 1796 he began his literary apprenticeship by translating Bürger's "Lenore" and other German ballads, some of which he published that year. He next translated German plays: Iffland's *Die Mündel* (as *The Wards*), von Babo's *Otto von Wittelsbach*, and Maier's *Fust von Stromberg* (as *Wolfred of Stromberg*). These exist in MS only, dated "1796-97," and another, his version of Schiller's *Fiesco*, has disappeared.

These play translations, done with more zeal than skill, strengthened Scott's interest in the medieval and supplied some slight material for his own later work. The most important influence was exerted on Scott by his next translation, published in 1799, of Goethe's *Götz von Berlichingen. The House of Aspen*, an adaptation rather than a translation of Veit Weber's *Die Heilige Vehme* followed, but was not published until 1830.

When Scott began doing original work, his apprenticeship to German literature was put to use. Macintosh, Carre, Brandl, Stokoe, and Roesel find the *Lay of the Last Minstrel* influenced by *Götz*, and German influence gradually diminishing in Scott's later verse-romances. In the *Waverley* novels the debt consists mostly of the working in of German material: words and phrases, notes, legends, and motifs from Goethe, Fouque, Spiess, and others.

Scott's interest in Germany continued throughout his life. He encouraged Germanophiles such as Skene, Lockhart, and Gillies; a German, Heinrich Weber, served as his secretary for ten years; he had over 300 German books in his library; his letters and journals reveal a continuing interest in things German; he helped others with their translations and publications of German material, and as late as 1827 he contributed a lengthy article on E.T.A. Hoffmann to a periodical.

Scott first became known in Germany through his *Minstrelsy*, but his popularity began after 1814 with *Waverley*. The Germans liked his blending of the romantic with the realistic, his high moral tone, and his documentation. His admirers ranged from anonymous reviewers to Goethe. Not only translations of his novels abounded, but many imitations, and some outright hoaxes such as *Walladmor* and *Schloss Avalon*.

The imitators took from Scott only the externals of his technique, not his use of local color, nor his sense of history. The German romantics -- Novalis, von Arnim, Fouque, and Tieck -- were hardly affected by Scott; not until 1826 with Zschokke's *Addrich im Moos* and Hauff's *Lichtenstein* did German novels deal with local history in

Scott's manner. Hauff especially was indebted to Scott as studies by Drescher, Thompson, Hofmann, Eastman, and Carruth show. Minor writers such as Pichler, van der Velde, Spindler, von Witzleben, Steffens, and Herloszsohn also wrote novels with varying amounts of influence by Scott.

In Alexis (1798-1871) Germany found its Walter Scott. Alexis proceeded from translations of Scott, through imitations (Walladmor), to a series of original novels dealing with Prussian history. Ewert, Korff, Fischer, Weede, and Fontane attest to Alexis' indebtedness to Scott. Other mid-nineteenth-century novelists writing in the Scott manner were König (1790-1869) and Schücking (1814-1883). With these writers the historical novel became tinged with didactic factionalism.

Scheffel's *Ekkehard* (1855) reveals that Scott's influence had now become so diffused that it is difficult to prove, even though many motifs are like Scott's. Of the novels of Fontane (1819-1898), only the first, *Vor dem Sturm* (1878), was Scott-inspired, according to Shears and Paul. Freytag (1816-1895) in *Die Ahnen*, a cycle of nine novels, attempted to encompass German history. Price and Ulrich claim Scott served as a model.

Toward the close of the century, the historical novel in Germany lost ground, becoming either professorial (Ebers and Dahn), or propagandistic (von Bolanden). With Ganghofer (1855-1920), the novels of the Waverley type lasted into the twentieth century, although derided by critics. The waning of this school of historical fiction coincided with the dwindling of Scott's German audience as publishers' statistics reveal. While it lasted, the influence of Scott, the vogue of his novels, and their emulation was greater in Germany than elsewhere.

Microfilm \$2.95; Xerox \$10.35. 228 pages.

THE INFLUENCE OF
LEARNED ITALIAN DRAMA OF
THE SIXTEENTH CENTURY ON
ENGLISH DRAMA BEFORE 1623

(L. C. Card No. Mic 60-4853)

David Orr, Ph.D.

The University of North Carolina, 1960

Supervisor: Werner P. Friederich

This study is an attempt to discover, gather together, and evaluate all the relevant secondary material relating to the influence of learned Italian drama of the sixteenth century on English drama before 1623. The bibliographical research involved precludes any wholesale study of original material, but in evaluating the work of others recourse is necessarily and frequently had to the study of primary sources. The work is concerned only with the *commedia* and *tragedia erudita*, the pastoral and the *tragi-comedy* in Italy, and not with either the *commedia dell'arte*, the masque, or with rustic or religious theater.

Such a study was deemed necessary because of the convenience of having a single reference source on the subject, and because at no point in the history of the sources of English drama have the contributions of Italian learned drama alone been considered. What attention has been

given to the matter previously has, as a result of being based on incomplete evidence, given perhaps a distorted picture of what real influence there was. Furthermore, the influence of Italian drama has been confused with that of other Italian literary forms, and has thus not been properly considered in its own right.

The study begins with a brief history of Italian drama from its beginnings to the seventeenth century. Such a survey was necessary in order to establish the definite character of the Italian drama which may have influenced England. The ways in which Italian writers imitated Rome are often those by which we may separate Italian influence in English drama from that of Rome directly.

The second chapter is devoted to a resumé of pertinent material concerning intermediaries in dramatic relations between England and Italy. The study of the Italian language in England, travels to Italy by English playwrights, Italian dramatists in England, travelling players of *erudita* plays, and books and printing are discussed here. The third, fourth, and fifth chapters deal respectively with comedy, tragedy, and *tragi-comedy-pastoral*. In each the English plays known to have Italian sources are considered, along with these sources, and some general considerations are also offered when the material seems to warrant it.

The considerations undertaken here have tended to show that on the one hand Italian drama was not a strong influence on English drama and that on the other hand most Italian influence was concentrated in comedy. Only four Italian pastorals and two tragedies are used at all significantly by English dramatists, whereas at least a dozen English comedies are heavily indebted to Italian sources. Little influence is predicated upon these indubitable cases, for half of them were in Latin and apparently confined to a university audience. The others appeared sporadically and only three of them, for whom very little influence has been suggested, appeared at a time early enough to have had some effect on the course of the development of English drama. It thus seems justified to say that Italian drama had very little influence on English drama at this time.

Microfilm \$3.75; Xerox \$13.05. 290 pages.

A READING COMPREHENSION TEST
FOR JUNIOR HIGH SCHOOL PUPILS
IN ALBERTA

(L. C. Card No. Mic 60-6750)

Arthur George Storey, Ph.D.
Stanford University, 1960

The purpose of this study was to develop and standardize a test in reading comprehension for use in urban junior high schools in the Province of Alberta. The development of a local test was necessary because available tests were considered to be inadequate for testing the degree to which the skills taught in the local curriculum enable the pupils to read the materials of that curriculum with comprehension.

A study was made of the reading comprehension tests in current use in the province so that the best features of these tests could be utilized in the new test. The language skills outlined by the curriculum were analyzed in order to determine the vocabulary, sentence, and paragraph

difficulty level at which the pupil was expected to perform. Basic texts in the skill subjects were reviewed to determine the level of performance necessary in order to read these texts with comprehension.

Test material was then prepared approximating the difficulty level found in the language course and in the basic text books. Multiple choice items were prepared to test vocabulary and sentence skills together with paragraph comprehension ability.

This pre-test was administered to a small group of pupils in grades six to ten. The results were treated statistically and discussed with teachers and other local educators. A revision of the pre-test was then drawn up and administered to the total population (371) of a representative junior high school. Through an item analysis of the results of this administration, items were selected for the final draft of the test. The test was then administered to a randomly selected sample of 1165 Edmonton pupils from grade six to ten inclusive.

The pupil responses obtained were treated statistically and found to be normally distributed and grade discriminatory. Grade, age, percentile and T-score norms were established for the test on the results obtained for the random sample.

Validity for the test was provided for through the method of test construction and was based on logic and educator consensus. Reliability was established through the split-half technique and checked against the Kuder-Richardson formula 21.

The normalcy and discriminatory power of the test was checked by administering it to the total population (495) of a second representative junior high school. Treatment of the responses demonstrated that the results were normally distributed and that the test discriminated among the junior high school grades.

It was concluded, therefore, that the test is an administratively practical, grade discriminatory, valid and reliable measure of the reading comprehension ability of the urban junior high school pupils of Alberta.

Microfilm \$2.75; Xerox \$4.00. 71 pages.

GEORGE MEREDITH:
A STUDY IN THEORY AND PRACTICE.

(L. C. Card No. Mic 60-6239)

Irene M. Sturges, Ph.D.
University of Utah, 1960

Chairman: Clarice E. Short

This study has a dual purpose: to organize George Meredith's critical theories about the novel into a coherent pattern and to apply those theories to three representative novels, *The Ordeal of Richard Feverel*, *The Egoist*, and *One of Our Conquerors*. Consequently, the first section describes Meredith's views on the function of literature, philosophy, realism, characterization, structure, style, and comedy; the second, by examining the novels in the light of Meredith's critical tenets, provides a basis for an appraisal of the achievement in each novel and, therefore, of the validity of the theories.

The starting-point for examining Meredith's critical

beliefs is his primary philosophical idea: blood, brain, and spirit constitute essential elements of man if he is to be harmonious with nature. An imbalance of these elements results in a deficient individual. Since Meredith believes that the purpose of fiction is to instruct the public about the nature of man and his problems and that philosophy should illuminate and direct the course of the novel, both views necessarily impose restrictions on the kind of novel he writes. His emphasis is ethical, not aesthetic. Lengthy and frequent explanatory passages often interrupt the narrative; sometimes these interpolations aid greatly in interpreting characters and in intensifying interest in the action, but at others they impede the story unnecessarily.

Another of Meredith's critical beliefs is that structurally the narrative, plus minor scenes, should build to major dramatic scenes which exhibit fully the essential qualities of characters. Ordinarily he uses dramatic treatment effectively, although some novels (*The Ordeal of Richard Feverel* and *One of Our Conquerors*) end abruptly, with inadequate dramatization.

Meredith's theory of character-drawing depends not only upon dramatic presentation, but also upon dialogue, description, and interpretation. A corollary of his method is that the characters determine the direction of the plot, and he therefore seldom uses coincidence.

His concept of realism imposes on Meredith the necessity for psychological truth in the portrayal of characters. He believes in steering a careful course between sentimentalism and gross naturalism, and consequently uses the degree of realism necessary for psychological portraiture. Though he deals honestly with sexual relationships questionable by Victorian standards, his focus is on psychological aspects, not physical.

Style, Meredith thinks, should be adjusted to the subject, but he also believes that many subjects need a somewhat poetic treatment. He writes simply when describing uninvolved emotion or when conveying a dramatic scene, but generally his style is complicated by unusual syntax, difficult sentence structure, and poetic devices like metaphor and allusion. Essentially, however, his style is an inextricable part of the writer, and acceptance of it depends on personal taste.

The chief benefit of comedy is its civilizing influence, according to Meredith's theory. The comic spirit applies its corrective to the follies of men and women in a social setting, viewed through a selective and unrealistic, but intensified, vision. The style is heightened to give full play to the comic spirit. For a comprehensive study of Meredith's novels, however, the theory of comedy must be applied judiciously, since it does not encompass the wide range of his interest in the human scene, his belief in the deep moral and philosophical functions of literature, his sensitive awareness of the complexity of human beings. Most of all, comedy reveals only one aspect of "tragic life."

Microfilm \$3.20; Xerox \$11.25. 246 pages.

LANGUAGE AND LITERATURE, CLASSICAL

STUDIES IN THE MANUSCRIPT TRADITION
OF STEPHANITES KAI ICHNELATES

(L. C. Card No. Mic 60-3975)

John-Theophanes Papademetriou, Ph.D.
University of Illinois, 1960

Towards the end of the eleventh century A. D., Symeon Seth translated from the Arabic into Greek the fable book *Kalilah wa Dimnah*. Symeon Seth's rendition bore the title *Ta kata Stephaniten kai Ichnelaten* and served in turn as the basis of a number of translations into other languages.

The translation of Symeon is extant in more than thirty-five manuscripts varying in contents. Of these, only a few have been explored while most of them have been virtually unknown. As a result, what is known about the text has been based on a slim foundation and a survey of its whole manuscript tradition has been long overdue. We have undertaken this task with a view both of evaluating the Greek tradition and of defining the relation of the Greek text to its Arabic source and to its various translations into other languages.

The most important contribution to our knowledge of this Greek text was made by V. Puntoni in 1886 and 1889. Puntoni examined nine Greek manuscripts and compared them to the Arabic texts that had been edited by that time. Thus, he distinguished four recensions in the Greek text and also established its order in accordance with the Arabic.

Our study of some thirty-five manuscripts has resulted in the distinction of six different recensions. The most important recensions are those numbered I, II and III. By and large, recension I is closer to the original form of Symeon's translation in terms of contents and their arrangement. It contains three prefatory Chapters and fifteen regular Chapters. The last two of the prefatory Chapters (B and C) are abridged and fused into one. In this particular respect, recension I deviates from the original form of Symeon's translation.

Recension II is a very complete recension including the three prefatory Chapters in the best form, unabridged and as independent units, and all fifteen of the regular Chapters, but in an order differing from that of recension I.

Recension III is an abridgement of Symeon's translation made around the end of the eleventh century. In its original form it included eight of the regular Chapters and possibly the last two prefatory Chapters. This abridgement was made on the occasion of the publication of a series of popular texts in which *Stephanites kai Ichnelates* was included. Recension III preserves many readings that reflect more accurately the text of Symeon Seth than the readings of the other recensions. This is due mainly to the early date of some of the manuscripts in which it has been preserved.

Concerning the relation of the Greek text with its offshoots into other languages, a number of facts became established.

The Slavic translation made in the twelfth or thirteenth century was based on the Greek recension V which has now been recovered. The Italian translation attributed to Nuti drew on two Greek manuscripts belonging to recensions I and III, now identified. The rendition of Symeon's text into sixteenth century Greek made by Th. Zygomalas was

derived from recension II. Many new manuscripts of this rendition have been noted. Possinus' source for his Latin adaptation of the Greek was codex Barberinianus 72. Finally, the relation of the Greek with the Arabic is discussed and several tables are included indicating the contents and interrelations of most Greek manuscripts.

Microfilm \$2.75; Xerox \$9.45. 207 pages.

LANGUAGE AND LITERATURE,
LINGUISTICSTHAI AND ENGLISH:
A COMPARATIVE STUDY OF PHONOLOGY
FOR PEDAGOGICAL APPLICATIONS.

(L. C. Card No. Mic 60-6075)

Foongfuang Kruatrachue, Ed.D.
Indiana University, 1960

Chairman: Willis P. Porter

The Problem

The purpose of this study is to compare Thai and English phonology in order to determine the similarities and differences of their phonological systems, which help to identify and isolate the areas of difficulty in English pronunciation for Thais. The study seeks to provide a sound basis for the preparation of English pronunciation lessons for Thais, whereby important phonological habits may be formed.

Sources of Data and Procedure

1. A phonemic analysis of Thai, based on the recorded Thai speech of six Thai informants.
2. A phonemic analysis of English, based on the works of American linguists, the choice being made of the systems which seemed to be most advantageous for Thais.
3. A comparison of Thai and English phonology, presenting the points of similarity and difference and their effects in the English pronunciation of Thais.
4. The verification of findings, based on the recorded English speech of 20 Thai informants. The speech of two native Americans was recorded for the analysis of prosodic elements. The difficulty in pronouncing various sounds of English was shown in terms of the most common deviant for each sound, the frequency of each deviant, and the total percentage of deviation.

Findings

Phonemes of Thai:

Tones: Mid, low, falling, high, rising

Vowels: Simple--/i, e, æ, ɪ, ə, a, u, o, ɔ/, each having a reduction feature / . / to form a corresponding set of reduced vowels; diphthongs--/ia, ia, ua/; reduced forms of diphthongs are not usual.

Consonants: Stops--/p, ph, b, t, th, d, c, ch, k, kh/;
spirants--/f, s, h/; nasals--/m, n, ŋ/;
liquids--/r, l/; glides--/w, y/.

Phonemes and Phones of English:

Vowels: Lax--/i, e, a, u, o, ɔ/; tense--/i', e', a',
u', o', ɔ'/; unstressed--/ɪ, ə/; diphthongs--
/ay, aw, oy/.

Consonants: Stops--/p, b, t, d, č, ĵ, k, g/; frica-
tives--/f, v, θ, ð, s, z, š, ž, h/; nasals--
/m, n, ŋ/; lateral--/l/; semivowels--/w,
r, y/.

Stress Phones: [Primary, secondary, tertiary, weak]

Juncture: Plus, single-bar, double-bar, double-
cross

Pitch Phones: [1 2 3 4]

The difficulties in English pronunciation for Thais are primarily the result of the projection of the Thai sound system onto English. The observed difficulties can be classed into two types: Type 1--those which interfere with communication in English, and Type 2--those which do not hinder communication, but which sound foreign to native English speakers.

Applications

In preparing English pronunciation lessons for Thais, the following steps should be observed:

1. Difficulty Type 1 needs greater attention than Type 2.
2. The most common deviants need more attention than others.
3. The total percentage of deviation of a phone suggests the emphasis it needs in relation to others of its own type.
4. Greater emphasis should be placed on sounds with high frequency of occurrence.
5. Practices should be made in words or groups of words which signify something for communication.

Conclusions

This study is basic in that it deals with the first problem in learning a language--its phonology, the mastery of which will be the key to that of other aspects of English. However, it should be supplemented by comparative studies of Thai and English morphology and syntax before a complete set of materials can be produced in the field of teaching English to Thais.

Microfilm \$3.00; Xerox \$10.35. 229 pages.

SPANISH VERB MORPHOLOGY

(L. C. Card No. Mic 60-6299)

Donald Ardell Leuschel, Ph.D.
Indiana University, 1960

Chairman: Sol Saporta

This study concerns the evaluation of alternative grammars. Any evaluation procedure is arbitrary. We can only

require that the criterion select that which we would select intuitively. If the criterion and our intuition do not agree, the criterion must be rejected. If they do, the criterion is valid. Thus, the criterion makes the basis of our intuition precise. The criterion should reject everything that we reject intuitively, and ideally it should provide us with an unambiguous answer in those cases where we are in doubt.

In this study a method for evaluating alternative grammars within each of three generative models is proposed. One of the requirements of a grammar is that it be "simple." With a corpus of 123 Spanish verb forms, several generative grammars are set up within the finite-state, phrase structure, and transformation models. A quantitative definition of "simplicity" is proposed, and the grammars are evaluated in terms of this criterion.

For the finite-state grammars the possible criteria include the number of states, transitions, and primes. It is shown that the criterion of fewest states means that a list is the simplest grammar. But this is counter to our intuition and therefore rejected. The criterion of fewest primes is rejected because this number could always be reduced to the number of phonemes in a language, thus doing away with the morphological level in language. It is decided that the grammar with the fewest transitions is the simplest.

In the case of both the phrase structure and transformation models, the possible criteria include the number of rules, symbols and primes. Again, the grammar with the fewest rules represents a list; the number of primes is reduceable to the number of phonemes in the language. Both of these are rejected. In both cases, the number of symbols is used as the evaluation criterion. The simplest transformation grammar has fewer symbols than the simplest phrase structure grammar.

Included is a transformation grammar of all Spanish verb forms. Microfilm \$2.75; Xerox \$3.60. 65 pages.

LANGUAGE AND LITERATURE, MODERN

THE PHILOSOPHICAL HISTORIAN: EMERSON'S THEORY OF HISTORY.

(L. C. Card No. Mic 61-265)

John Morgan Adams, Ph.D.
University of Kansas, 1960

The inquiry is intended to show as clearly as possible the details of Emerson's ideas about history. The study focuses upon the essay "History" and involves a close reading of it, in conjunction with the relevant passages from Emerson's journals. Since the journal entries upon history are substantial and represent the thinking from which the essay evolved, full advantage is taken of the contribution which they make to the understanding of "History."

In Chapter I, the relevant journal entries are brought to bear in order to establish and elucidate Emerson's definition of history, his view of historical progress, and his theory that history enlarges internal human elements. In Chapter II, these ideas are related to the context of

systematic historical theory provided by the work of the French philosopher Victor Cousin.

Chapter III treats Emerson's view of how history should be explained, drawing upon the extensive journal entries upon the general theory of explanation, the philosophy of history, and the method of historical inquiry. The first aspect of Emerson's theory of explanation is that the circumstances relevant to an historical phenomenon must be considered in order that its causes may be known.

Emerson's view of cause and effect is examined, in relation to his conception of "necessary reason." The second aspect of Emerson's theory of explanation is that particular phenomena must be seen as instances of laws. An analysis is made of the method which Emerson proposed for finding historical laws, of the kind of law thus found, and of how such laws may be applied to history. Emerson's method of historical inquiry is closely related to Cousin's, while for the actual content of the laws treated in journal and essay, Emerson was indebted to the work of Arnold Heeren. The third aspect of Emerson's theory of explanation is the part played by the perception of the common element present in a variety of dissimilar forms. For this principle, Emerson was indebted to Goethe; in his application of it to history, he shows affinities with Cousin.

Chapter IV treats Emerson's view of the place which man's relation to the natural world should occupy in his history. After an exposition of Emerson's theory of how man is related to nature, and of the similarities which Emerson saw among history, geology, and physiology, the chapter examines Emerson's reasons for the inclusion of an account of man's relation to nature in the total history of man.

Chapter V considers Emerson's conception of comprehensive history and the conditions upon which such a history is possible. In agreement with Cousin, Emerson held that the comprehensive history should include accounts of all man's activities in all times and places, that it was likely to be a product of the nineteenth century, that historical phenomena should be explained according to laws inherent in the human mind, that incomplete histories could be explained in specific ways, and that the qualifications of the ideal historian were, necessarily, more ethical than intellectual. In proposing comprehensiveness and a concern with explanation, Emerson was advocating that the historian be "philosophical."

In Chapter VI, Emerson's approach to history is placed in relation to attitudes prevalent in his time and since. His attitude was distinguished from certain approaches, in conformity with others. In some particulars, it anticipated that taken by at least one twentieth-century thinker.

Appreciation of Emerson's artistic methods depends upon the detailed knowledge of the ideas which he treats. The study tries to provide this knowledge for "History," so that it may be better appreciated as a work of art.

Microfilm \$2.75; Xerox \$8.80. 192 pages.

ROMANTICISM AS REFLECTED BY
LE MERCURE DE FRANCE
(1815-1830)

(L. C. Card No. Mic 61-290)

Clarence Hal Albro, Jr., Ph.D.
University of Kentucky, 1956

Director: Dr. T. C. Walker

The *Mercur de France*, which was in publication longer than any principal French magazine during the period 1815-1830, is generally regarded to have been a magazine in support of Classicism from 1815-1820 and in support of Romanticism from 1823-1830.¹

A study of the *Mercur* shows that during the period 1815-1820 Romanticism was generally discounted as being a serious literature and certainly not a force which could endanger French Classicism. The critics could see nothing serious in the ideologies advanced by the German Schlegel or by Madame de Staël. Shakespeare, with his barbarousness, certainly offered no threat, not even in Classical adaptations. Eighteenth century tendencies toward Romanticism were not considered worthy of examination, and the return to the Middle Ages was boresome in Mme de Genlis' novels and on the stage. An occasional poem relating the deeds of phantoms and specters in imitation of German poets was a novelty in which the *Mercur* could indulge its readers. Even the publication of André Chénier's poems in 1819 caused no concern. Chateaubriand, the one precursor of French Romanticism who was still alive--Madame de Staël died in 1817--likewise caused no concern to the Classical *Mercur*.

The critical attitude of the *Mercur* toward Romanticism during the years 1823-1830 falls into four divisions: an anti-Romantic phase (1823-1824) in which Romanticism was consistently attacked; an internal dissension period (1825-1826) in which Latouche supported the Romantic cause against anti-Romantic critics; an eclectic phase (1827-1828) in which it was believed that the quarrel would be resolved in a *juste milieu*; and a Romantic phase (1829-1830) in which Hugo was wholeheartedly supported along with the other Romanticists.

The critics wrangled at length as to the meaning of Romanticism, each attacking or defending the particular characteristic he considered desirable or undesirable. However, despite the confusion, they apparently had a good understanding of the characteristics of the new literary movement. They were consistently favorable toward Sir Walter Scott and Manzoni, but Shakespeare, Lord Byron, Goethe, and Schiller all possessed certain aspects of Romanticism which they rejected until 1829. Even when Shakespeare was being staged in Paris by an English troupe, the critics reported his success somewhat reluctantly.

The return to the Middle Ages was not displeasing to the critics. They repeatedly noted the need for a better knowledge of France's past. However, they usually found fault with the use of medieval material except in closet dramas and in *Henri III*.

The critics were not especially interested in pre-Romantic tendencies of the eighteenth century. Delille's descriptive genre was praised, and one critic saw the germs of Romanticism in his verses just as another saw them in Voltaire's dramas.

Due to variations in critical policy, Lamartine, De Vigny,

Hugo and Minor Romanticists were blamed or praised for their Romanticism. Lamartine and De Vigny were more acceptable throughout the period than was Hugo. Hugo apparently represented one of the extremes in Romanticism which even the eclectic policy would not admit. Dumas and Mérimée were the Romanticists who were most generally liked by the *Mercure*.

In 1829 an unexpected change of policy occurred when Hugo dominated a complete volume (XXIV). Romanticism, not only in Hugo but in others, was aggressively defended and exalted above all other literature. Up to then the critics had failed to discuss the innovations which Hugo, Sainte-Beuve, and others had made in poetry. The praise of Romanticism was so extensive that the following volumes seemed lifeless in contrast. This lack of vitality appeared in the review of *Hernani* and was more apparent after the Revolution of 1830.

1. Its name was changed to *Le Mercure du dix-neuvième siècle* in 1823 and to *Le Mercure au dix-neuvième siècle* in 1827. Microfilm \$3.95; Xerox \$13.95. 306 pages.

LUTHER'S SERMONS
AS A MIRROR OF HIS TIME

(L. C. Card No. Mic 60-6974)

Ieva Asmyte, Ph.D.

The University of North Carolina, 1960

Supervisor: John G. Kunstmann

As Luther's sermons comprise the least studied portion of his works, this investigation undertakes to collect and interpret hitherto scantily utilized data which contribute to our understanding of sixteenth century conditions and of the Reformer's activity in the cultural context of that era. Wherever possible, collation with contemporary materials, primarily letters, official documents and chronicles, is employed as a means of illustrating the significance of Luther's utterances. We show to what an extent the Reformer depended on the traditional method of interpreting Scripture allegorically, how he gradually disengaged himself from allegorization and what is characteristic of his own practice as an allegorizer. Sixteenth century deterioration of morality, which contemporary and later Catholics blamed on the Evangelical movement, is attested by numerous sermonic utterances of the Reformer. A presentation of Luther's more general censures that his followers abuse their Christian liberty is followed by a discussion of his preaching against the specific sins of greed, gluttony, drunkenness and extravagance in dress. The Reformer's declaration of avarice as the besetting sin of men is supported by his numerous utterances concerning the decrease of charity, the inadequate support of ministers and schools, profiteering and usury. Since Luther's time was the golden age of gluttony and drunkenness, his sermons contain many censures of these specifically German frailties. Describing their extent, the Reformer points out their fateful consequences and advocates sumptuary laws as a means of combatting them. Because the checking of extravagance was deemed to be the responsibility of secular authorities, his censures of overdressing are less frequent. But even they reveal how the Renaissance spirit and the age of discoveries encouraged conspicuous consumption. Since dancing in the sixteenth century was a controversial pas-

time, Luther's sermonic discussions of it are of particular interest. In conscious opposition to the Anabaptists, Catholic ascetics and to the severe moralists of the Reformed camp, Luther endorsed dancing thereby declaring himself against a "new monkery" and for the people's time-honored customs. However, abuses--obscene dancing songs and gestures, the immodest whirling of certain fashionable dances--he censured just as severely as the "sour-faced pharisees." A number of Luther's exhortations afford an interesting commentary on sixteenth century student life. The young scholars' unruliness, their prodigious spending, rioting and contraction of debts provoked these public reprimands, for edicts of the University of Wittenberg show that the consequences of such behavior were, indeed, far-reaching. The students' sloth, their licentiousness in sexual matters and their vituperation of people were also censured from the pulpit. Contrary to the assertions of his Catholic critics, Luther often spoke about the punishment of sins. Whenever he explained that pestilences, floods, the dreaded mercenary soldier, the Turkish invasion and other calamities are wages of wickedness we realize how deeply rooted Luther still was in medieval ideas. His frequent announcements that Doomsday, the supreme punishment, is impending express the apocalyptic mood of his era.

Microfilm \$5.60; Xerox \$19.80. 438 pages.

PROUST'S NOCTURNAL MUSE:
DREAMS.

(L. C. Card No. Mic 61-245)

William Stewart Bell, Ph.D.
Columbia University, 1960

This study traces the theme of dreams and sleep in the work of Marcel Proust and ascertains the role played by his nocturnal muse, dreams, in his literary masterpiece, *A la recherche du temps perdu*. Psychological and psychoanalytical techniques are entirely excluded.

The Proustian juvenilia and correspondence reveal an early interest in dreams and demonstrate Proust's increasing mastery and depth of analysis. In *Contre Sainte-Beuve*, Proust's reflection on Nerval's technique led him to resolve to carry it even further: "Allons plus loin que Gérard."

The dreams contained in *La Recherche* are examined in Chapter II and their characteristics set forth, supplemented by the author's explanations. Foremost among them are dreams that are interpreted; dreams revealing the deep subconsciousness; dreams constituting an artistic synthesis; dreams demonstrating "the heart's intermittences"; and dreams illustrating the recapture of the past, the manipulation of time (*jeu avec le temps*), and the extra-logical unity created between irreconcilables (dream logic).

Next the dream is considered in the light of its contribution to the novelistic aspect of Proust's work. It is seen to delineate character, notably that of Marcel. For the Narrator it charted his course towards achieving his artistic vocation, offering an index of his spiritual progress, revealing his subconscious motivations. Dreams act as correctives for the erroneous impressions created by the character's social actions. As an instrument for probing the subconsciousness, dreams furnish revelations about time, emotions, and memory. Recapturing the past self

through dreams convinced the Narrator of the unity of his *moi* despite its apparent disunity. The origins of the dream about Venice are explored because this dream reveals the unexploited creative potential present in Marcel. It demonstrates simultaneously the supra-logical metaphorical expression of art. Immersion in the milieu of dreams served as inspiration and furnished the model for Marcel's eventual creation. Dreams perform the same functions as involuntary memory and enjoy the advantages of longer duration, frequent occurrence, and the ability to store materials to be tapped later by the artist. The Narrator places his work under the patronage of both the nocturnal muse and involuntary memory.

In the structure of *La Recherche* dreams sometimes accompany involuntary memory, sometimes substitute for it. They occur at crucial junctures in the work's structure, starting and ending episodes and effecting transitions between them. The series of bedrooms mentioned in *Swann* afford a thematic reference and permit the re-establishment of the subjective dream-related current after excursions into waking reality.

The Narrator's discovery of unity within himself required him to portray his past as containing it, without, however, anticipating that revelation. Dreams afford, Proust states, the only new method of recounting. He applies dream techniques, with their characteristic temporal and spatial revolution (oneiric optics), to impose unity upon disparate waking occurrences. Sensory impressions, undistorted by intellectual interpretation, contain a true vision of reality. The augmented intensity of sensations in dreams and abnormal states (madness, homosexuality) renews experience, freeing it from stultifying habit. The social blocks of *La Recherche* reveal a welter of deception, misunderstandings, mistaken identity, and "comedies." The oneiric atmosphere which suffuses these scenes, by respecting the order of sensory perceptions, endows them with truth and transforms them into art. Illusions contain the basis of true perception; lies reveal truths they attempt to conceal; beneath ostensible disorder an obscured pattern is present; discontinuous experience is united by a unified vision of time and space. Metamorphoses of objects and characters reveal their essences and integrate them into the Narrator's affective vision. Since dreams penetrate its every aspect, *La Recherche* "... stands alone as a true dream novel among works of social observation."

Microfilm \$6.10; Xerox \$21.60. 480 pages.

SAMUEL BECKETT:
THE COMIC GAMUT.

(L. C. Card No. Mic 60-6761)

Ruby Haykin Cohn, Ph.D.
Washington University, 1960

Chairman: Jarvis A. Thurston

The oeuvre of Samuel Beckett, a uniquely bilingual writer, has been accorded relatively scanty critical analysis. This study attempts an elucidation of his work, largely through tracing the development of his conception of the comic.

In his English writing, published during the 1930's,

Beckett uses fairly conventional laughter-evoking devices, much as they were classified by Bergson -- caricature of character, twists of plot, and a broad repertoire of linguistic play (pun, jargon, misquotation, misplaced literalism, litotes, hyperbole, parody, paradox, incongruity, and irony). Beckett's short stories are studded with polished gems of wit, but the collection lacks a meaningful setting. His first novel, *Murphy*, continues the linguistic exuberance of the stories, but there are also hints that the old tradition of the illiberal jest is viewed as an expression of cosmic irony. More originally and fundamentally Beckettian, the examination of Murphy's mind is conducted in an ambiguously ironic tone.

In Beckett's second (and last) English novel, *Watt*, the elegant style is abruptly abandoned, coherent plot is jettisoned, and the hero is focussed in his metaphysical and epistemological situation. Although there are occasional echoes of social satire, the brunt of the book is borne by Watt's rational efforts to penetrate Mr Knott's irrational establishment. Incidental comic techniques of the earlier works -- literalism and contradiction -- become prime linguistic instruments in the exploration of the absurd human condition.

Directly after the war, Beckett adopted French for composition, although he subsequently translated his French works into English. In *nouvelles*, novels, and plays, an incisive and colloquial violence replaces the elegant mockery of *Murphy* and the meticulous logic of *Watt*. Incongruity and *non sequitur* abound, confusion and contradiction are rife; obscenity and savagery proliferate. If rational motivation and reasonable order ever existed, they are forgotten. In Beckett's French works, man is steeped in an immediate and often hilarious absurdity.

Increasingly grotesque and immobile, Beckett's first-person heroes self-consciously tell their tales -- vaguely oral in the *nouvelles* and *textes*, explicitly written in the novels. By the fictional time of writing, the protagonists of Beckett's trilogy are reduced to virtual immobility, and much of their power to move us is achieved through extreme and ludicrous concentration of the usual fictional components -- "the principle of parsimony." The more amorphous events become, the more clearly man is pinpointed as a victim. The more chaotic the prose grows, the more intense is the emotional involvement.

In the trilogy especially, episodes and episodic characters center on quests -- Molloy's for his mother, Moran's for Molloy. Malone, dying, seeks peace through stories, and the Unnamable, perhaps dead, perhaps unborn, seeks to penetrate behind linguistic and fictional formulae to himself.

In the drama, the onstage juxtaposition of different characters diffuses the single-minded search for identity and meaning. Nor is society absent from Beckett's plays (the two sets of couples in *Waiting for Godot*, the families in *Endgame* and *Embers*, the village in *All That Fall*). Even these dramatic creatures are essentially alone, however, when they face creation and, perhaps, a creator.

More and more nakedly, Beckett's heroes depend upon his and their fictions to teach them about themselves and the world. In the trilogy Moran refers to Murphy, Watt, Yerk, Mercier; Malone groups "the Murphys, Merciers, Morans, and Malones"; and the Unnamable carries on a constant intercourse with Molloy and Malone, Mahood and Worm. So, Beckett shows, all knowledge arises from a dialogue between man and his fictions. Fiction is our only

knowledge, and all knowledge a fiction written in a foreign tongue. Nothing, finally, is ever learned, and yet, ironically, man's mind keeps battering at the ramparts of nothingness -- within Beckett's literary structures. Man's compulsion for knowledge, man's impermeability to knowledge -- this cruelly comic tension is the vibrant spring of Beckett's art.

Microfilm \$3.50; Xerox \$12.40. 271 pages.

FORM AND MEANING IN THE GOLDEN BOWL

(L. C. Card No. Mic 60-6954)

Merivan Robinson Coles, Ph.D.
Bryn Mawr College, 1960

My intention in this dissertation has been to examine the function of James's techniques in The Golden Bowl. Perception of content, by which I mean both the literal and the symbolic levels of meaning, is governed by perception of form, for we see nothing in its essence in The Golden Bowl, but only in the relations imposed by form. Failure on the part of critics to describe clearly the function of James's techniques on both levels of meaning has led to a multiplicity of interpretations of the novel and considerable lack of agreement as to what actually happens in the book. The two kinds of confusion are of course intimately related; to clear them up we must analyze James's effects in the order in which he placed them, for the symbolic fable emerges only gradually and indirectly through the development of the literal plot. The fable's power to compel assent to the author's insight depends upon its relation to the literal story, and both depend for their success upon the author's techniques.

The Golden Bowl is divided into two Books, and each Book has three Parts. Book I is subtitled "The Prince" and Book II "The Princess," the chief focus of interest in each Book being upon the character whose name the book bears. In six chapters I have examined respectively the six Parts into which the novel is sub-divided. At the outset a distinction is made between two kinds of action. There is the superficial action, the events of the plot, and there is what James thought of as the true action--what some character makes of those events. The complex relationship between form and levels of meaning is shown by the fact that in Part I, for instance, we see the plot unfold through the Prince's consciousness, so that his point of view is both a technical device for presenting the superficial action and a substantive part of the true action.

This distinction is partly methodological, for the two levels of the story interact in the way suggested by James's rhetorical queries, "What is character but the determination of incident? What is incident but the illustration of character?" Through the techniques by which the superficial action is represented--foreshortening, point of view, imagery, the dramatic scene--James gradually creates in Parts I and II a network of motive and circumstance which will inevitably lead to the catastrophe with which Book I ends, the Prince's resumption of his affair with Charlotte. When the Prince finally sees why he is acting as he does, in Part III, there is a shift on James's part from techniques of indirect representation of motive to techniques of direct

and explicit statement, a clear demonstration of how all the forces making for action are converging at last on the level of the plot.

In Book I James creates the situation which is the basis of the action in Book II. Again we see the interaction of incident and character, circumstance and motive, through technique. The plot and the underlying action of Maggie's mind are both represented through Maggie's point of view. As she works to end the adulterous relationship between her husband and Charlotte and to rebuild her marriage, she seems to be coming to accept her share of responsibility for that relationship, and does so, in fact, quite explicitly at the end of Part IV. But the convergence of the two aspects of the action on the level of the plot does not mean, as the reader would expect, that in Parts V and VI we are to see Maggie acting out her sense of responsibility. In fact James employs two techniques which contradict each other. The surface action seems to be a dramatic representation of Maggie's achievement of self-awareness, as well as a brilliant symbolic representation of the underlying meaning of the story; but through Maggie's point of view James shows explicitly--and perversely, it seems--that in fact her experience has meant nothing to her. The symbolic fable has become strangely unrelated to the literal story by the end of Part V, and the contradictions inherent in James's techniques are resolved in Part VI in such a way as to disappoint the reader's expectations of the outcome of the plot and to obscure the meaning of the fable.

Microfilm \$2.85; Xerox \$9.90. 218 pages.

DAS BILD DER HEIMAT BEI EINIGEN OSTPREUSSISCHEN AUTOREN SEIT DER JAHRHUNDERTWENDE. [German Text].

(L. C. Card No. Mic 60-4079)

Ilse-dore Maria Edse, Ph.D.
The Ohio State University, 1960

This study attempted to demonstrate how some selected pieces of regional literature present a picture of the country and its people. The works of five representative East Prussian novelists served as the basis of the dissertation. The complete volumes of Ernst Wiechert and Agnes Miegel were used as well as the most recent novel by Otfried Graf Finckenstein, Schwanengesang, William von Simpson's Die Barrings, and Gertrud Papendick's Die Kanther-Kinder. This selection was made to limit the material to authors whose time of productivity falls within the twentieth century. Although the latter three writers are greatly overshadowed by two former, considered among the greatest East Prussian novelists, their novels serve as an adequate mirror of the scenic and social milieu of their country.

Chapter I, Die Landschaft als Bild und Seelenspiegel, examines the individual author's attitude toward his native countryside. The landscape of primeval forests is emphasized in the writings of Ernst Wiechert, while the region along the coast of the Baltic Sea is depicted by Agnes Miegel and Gertrud Papendick. The great estates of the aristocratic landowners in the western and eastern parts of

the province, respectively, are described in the novels of the other two writers.

Chapter II, Menschentypen, is concerned with the people of East Prussia. Here, too, differences among the five authors appear very clearly, each portraying primarily the people with whom he had the most intimate contact. Ernst Wiechert introduces the simple inhabitants of the villages in the vast forests of Masuria: the foresters, fishermen, and shepherds. Agnes Miegel divides her attention between the people of East Prussia's past, who display attitudes that she considered still typical of the present population of East Prussia, and the middle-class society of her hometown Königsberg. Gertrud Papendick concentrates on the merchant class of this city at the turn of the century. The East Prussian landed aristocracy appears exclusively in the two novels by Ottfried Graf Finckenstein and William von Simpson.

Die Sozialen Schichten, Standesbewusstsein und Standesunterschied are treated in Chapter III; Social types and social situations are illustrated by showing some significant features of class consciousness in everyday life situations.

Chapter IV examines Familie und Umwelt with emphasis on marriage life, marriage conflicts, the status of women, and differences between the old and young generations.

Chapter V presents a study on Politische Haltung. Only the views of three of the authors appear, since Agnes Miegel and Gertrud Papendick are unconcerned with political attitudes and problems.

The interest of the East Prussians in theatre, opera, concerts, the arts and science is discussed in Chapter VI, Geistige Interessen. Landed gentry and the higher bourgeoisie in the capital city are among the most serious patrons of the arts.

Chapter VII, Die Schule, is a study of various views on schools and teachers. Here Ernst Wiechert showed greatest concern by pointing toward existing malpractices in the educational system and by criticizing the abuses on the part of the teachers.

Chapter VIII, Religion, deals with some aspects of religious training and the attitude of the East Prussian toward church and clergymen.

Chapter IX deals with Volksbräuche und Volkssitten. Among the five novelists Agnes Miegel's and Ernst Wiechert's works reflect best the traditional beliefs and customs handed down from generation to generation.

In conclusion, it is pointed out that in view of the fact that this study covers a period of over half a century and includes authors of very different backgrounds, their impressions of their homeland and its people furnish a picture of life and manners in this epoch.

Microfilm \$3.35; Xerox \$11.70. 258 pages.

XAVIER LAMPILLAS:
HIS DEFENSE OF SPANISH LITERATURE
AND HIS CONTRIBUTION TO LITERARY HISTORY.

(L. C. Card No. Mic 60-5393)

M. Carl Gibson, Ph.D.
University of Oregon, 1960

Adviser: Perry J. Powers

After Francisco Xavier Lampillas had been exiled from Spain, he continued his literary pursuits in Italy. He was disturbed by the attitudes which the Italian literary historians Tiraboschi and Bettinelli held concerning Spain and Spanish culture. They blamed, as had most Italian writers, all of Italy's ills upon Spain, expressing the view that Spain was the source of all literary corruption and bad taste. Lampillas therefore wrote his Ensayo histórico-apologético for the purpose of combatting these accusations and prejudices, of disproving their unfounded claims to Italian superiority in all fields, and of offering to the world badly needed information concerning Spain's literary history and contributions to European culture. He also included claims to Spanish superiority and priority over Italy in certain fields.

The purpose of this thesis is to bring to light the specific accusations of the Italians, to analyze Lampillas' defense of Spain, and to determine the extent of the influence which this defense has had toward an understanding of Spain's contributions to European culture and toward the development of Spanish literary historiography.

The writer of this thesis has isolated the specific misconceptions and prejudices which were prevalent in Europe during the eighteenth and preceding centuries, and which have been reflected in the writings of the Italian literary historians. He then has analyzed in detail the defense of Spain against these prejudices: Lampillas' methods of defense, his arguments against the accusations, and his claims for Spain--at times very bold. Those areas where Lampillas seems to have been correct, and where more recent study has upheld him and his claims are pointed out, as are areas where his arguments are weak, and where more recent investigations have failed to uphold him.

It was found that most of the anti-Spanish feelings were in some way connected with the widely accepted theory of climatic influences which was so detrimental to Spain. The thesis includes an investigation of this theory, Lampillas' opposition to it, and his contributions toward its becoming obsolete.

One of Lampillas' claims concerns the part played by Spain as the source of literary models for the Provençal poets. Lampillas' arguments in favor of this thesis have been extracted, and the history of the theory of Arabic origins which grew directly out of Lampillas' claims has been outlined. A summary of the recent state of investigation in this field is also given.

One of the problems which confronted the writer of this study was to ascertain the state of literary history in Spain at the time of Lampillas, and to determine how Lampillas' Ensayo contributed to the rise of a tradition of literary history. He points out the various historical studies that predate the Ensayo and the fact that Lampillas' was the first treatise to be completed which dealt with all ages and genres of Spanish literature, making it virtually the first complete literary history of Spain.

This study of the *Ensayo* and of the circumstances under which it was written, bears out the fact that Lampillas made several very outstanding contributions to Spanish literature. Each of these contributions is discussed in detail in the thesis: he was the first to defend Spain against the age-old European prejudices and misconceptions, and against the accusations of the Italian literary historians; he was the one who crystalized and first publicly embraced the concept that Provençal poets followed a tradition of lyric poetry which had existed previously in Spain among the Spanish Arabs; he was one of the first scholars to oppose the generally accepted theory of climatic influences on the production of artistic genius, particularly as it was applied against Spain; and his was the first scholarly treatise on all genres of Spanish literature and may therefore be considered the first literary history of Spain.

Microfilm \$3.30; Xerox \$11.50. 255 pages.

CHAMPFLEURY'S CONTRIBUTION TO FRENCH LITERARY REALISM

(L. C. Card No. Mic 61-510)

Adolph Bernard Heller, Jr., Ph.D.
Syracuse University, 1960

A survey of previous works dealing with Champfleury's contribution to French literary Realism reveals that he has been ignored or disparagingly treated by the critics. This study, therefore, reappraises his role and defends him as a serious student of the realistic novel.

The basis of Champfleury's art and thought is determined by tracing the ancestry of realism in French literature from the Middle Ages to the nineteenth century and by examining the philosophical foundations of his writings. A comparison of Champfleury's realism with that of writers concerned with the average, commonplace, normal area of shared experiences of everyday occurrences proves that his art, like theirs, depends on accurate observation of detail. Although Champfleury's thought was affected to a certain extent by positivism, mysticism, and the social and aesthetic doctrines of Proudhon, the influence outweighing all others is the literary art and philosophy of Balzac.

Champfleury expresses his theory of the novel in the manifesto, *Le Réalisme*, in his *Cahiers*, in the prefaces to his novels, and in his letters. An exponent of *l'art social*, he is against art-for-art's sake, profoundly concerned with content, and scornful of ornate style. He subscribes to the organic theory of composition. In his theoretical writings Champfleury displays awareness of problems which confront the modern novelist, and many of his answers are still valid.

Stimulated by his admiration for the paintings of Courbet, Champfleury's technique is in many respects directly opposed to that of the romanticists and classicists. In order to create an illusion of reality he employs direct and impersonal observation of contemporary subjects and stresses the importance of environment, of facts, of autobiographical reminiscences, and point of view. He defends himself against charges of lack of imagination and lack of morality. By his use of humor, particularly caricature, Champfleury compensates for his lack of style.

The application of Champfleury's philosophy, theory, and technique is observed in the characters and action of his novels. The men and women he depicts demonstrate his belief that the outer man reveals the inner man and that environment and heredity determine character. The invisible spectator approach, "neutral omniscience," letters, and conversations provide examples of his technique. Because he focuses less attention on event than on analysis of character, the action in his novels is slow. As an illustration of Champfleury's treatment of characters and action, the novel, *La Succession Le Camus*, is discussed at length.

The conclusions reached are that Champfleury is more representative of Realism than Balzac, Stendhal, or Flaubert. His novels, however, claim the attention of today's reader solely because they are good records of the society of the Second Empire. His originality and his chief legacy lie in his theories which are carried on in the works of the Goncourts and Zola. In so far as themes are concerned, twentieth-century novelists of the commonplace are his disciples.

Microfilm \$2.75; Xerox \$7.80. 166 pages.

POEMS BY HERMAN MELVILLE: A CRITICAL EDITION OF THE PUBLISHED VERSE.

(L. C. Card No. Mic 60-6623)

Norman Eugene Jarrard, Ph.D.
The University of Texas, 1960

Supervisor: Dr. William B. Todd

"Poems by Herman Melville: A Critical Edition of the Published Verse" contains critically prepared texts, with variorum textual notes, of all of the original poems published by Melville. This includes (1) twenty-three pieces of verse from *Mardi*, 1849; (2) the seventy-two poems and the prose passages, plus one interpolated poem, comprising *Battle-Pieces*, 1866; (3) forty-one lyrics imbedded in *Clarel*, 1876; (4) the nineteen poems, including prose portions, of John Marr, 1888; and (5) the forty-two poems comprising *Timoleon*, 1891.

The basic materials for the edition include the first and only authoritative editions of the individual volumes and, in addition, manuscripts for two of the volumes. Specifically, (1) *Mardi* there is only one pertinent text, that of the American first edition. (2) For *Battle-Pieces* the Harvard collection has Melville's partially corrected personal copy and Mrs. Melville's copy with three corrections. Five of the poems were published separately in Harper's and offer some authoritative variants. A holograph copy of one poem, "Philip" ("Sheridan at Cedar Creek") is in the New York Public Library. One related poem, "Inscription for the Dead at Fredericksburg" was published, the latest manuscript is in the Library of Congress, with the published version of the manuscript now being in the Humanities Research Center of The University of Texas. (3) For *Clarel* there is only the first edition--Melville's partially corrected copy of which is at Harvard--and a holograph copy of one poem--"The Ditty of Aristippus," now in the library of the American Antiquarian Society.

For John Marr (4) there are unusually full materials in the Harvard Melville Collection. There are fragments of early drafts, the complete printer's copy, the corrected galley proof, and the corrected page proof. Available in addition is Melville's partially corrected personal copy of the book now in the New York Public Library, and several other libraries have copies with the corrections in Mrs. Melville's hand.

For Timoleon (5) the Harvard collection contains, in addition to scattered fragments, two complete manuscripts--one basically in Melville's hand and the other basically in his wife's. In the New York Public Library there is an early manuscript of one Timoleon poem--"The Age of the Antonines"--and the library of The University of Texas and library of Mr. C. Waller Barrett each has a fragment of other poems. Both of the full manuscripts of Timoleon were much revised by Melville, and there was a great deal of cross-correction. Melville's changes were usually in pencil which was erased after being inked in by Mrs. Melville. An interesting feature of Mrs. Melville's draft is that it was first made with only a few traces of punctuation, and then Melville added punctuation in pencil which again was erased after Mrs. Melville's inking in. The existence of these two rather peculiar drafts called for some elaboration and modification of current copy-text theory.

The most significant editorial feature of this edition appears in the copy-text for John Marr and Timoleon, both of which now have texts established directly from manuscript. The major result is that the edition contains, in addition to a great many variant accidentals, a large number of previously unrecorded substantive variants, all constituting the greatest addition to the published record since the publication of the journals. The evidence pertaining both to Melville's method of preparing a text and to later compositorial and editorial influence should prove to be important in the establishment of texts for which such evidence has not survived. Finally, of course, the critical text and its variant readings should contribute significantly to the understanding of individual poems and, through this means, to a further appreciation of a major American writer. Microfilm \$5.30; Xerox \$18.70. 415 pages.

AN EXAMINATION OF THE
CULTURAL MATERIALS IN THE
STATE-ADOPTED TEXTBOOKS CURRENTLY
IN USE FOR THE TEACHING OF SPANISH
IN THE SECONDARY SCHOOLS OF TEXAS

(L. C. Card No. Mic 60-6624)

Sylvia Viera Jeffery, Ph.D.
The University of Texas, 1960

Supervisor: James W. Reynolds

This study consisted of an examination of four series of two books each, now currently in use for the teaching of Spanish in the public high schools of Texas. It tried to determine the extent to which the cultural materials in the texts contribute to an understanding of the cultural-social and linguistic-behavior of Spanish American people.

The criteria for validation were based on the modern

synthesis evolved by the studies of man as a social and verbal participant in the activities of a societal group. The study assumes that the act of communication is the expression of man's conception of his world, of his relationships to the group, and of his interpretation of the self.

In the light of the contributions of the behavioristic sciences, both social and linguistic, the study of a language also involves the study of a culture. This study can no longer disassociate the areas of language and culture; moreover, it cannot present a description of the culture in a historical approach but must approach it from a functional aspect. In like manner, the study of a language cannot follow the formalistic and deductive method of *a priori* categories and generalizations.

The teacher of a foreign language shares in the responsibility of the social sciences to present a culture as it is, as a framework for the linguistic patterns of a people.

The author of textbooks must provide the materials which scientifically selected, organized, and presented will allow the cultural-linguistic attainments of the classroom teacher and of her foreign-language students to come to fruition.

The textbooks examined were found to be lacking in the interpretation of a culture through the analysis of its linguistic patterns and semantic correspondences, and in the interpretation of the linguistic forms of a people as the expression of their ontological viewpoint and psychological motivations.

The terminal point of the study is a series of conclusions on the nature of the inadequacies of modern Spanish textbooks to achieve the synthesis and of recommendations for the preparation of teachers and of textbooks in the area of Spanish studies.

Microfilm \$2.75; Xerox \$9.45. 206 pages.

EUNICE TIETJENS:
A BIOGRAPHICAL AND CRITICAL STUDY.

(L. C. Card No. Mic 61-424)

Willie Nell Stallings Love, Ph.D.
University of Maryland, 1960

Supervisor: Dr. Leonard Lutwack

This is the first extended study of the life and work of Eunice Tietjens (1884-1944). The purpose of this research is to examine Mrs. Tietjens' life and work critically and to investigate her contributions to that seminal period in the development of twentieth century poetry known as the Chicago renaissance. This study assesses her creative powers, places her in the literary movement to which she belongs, analyzes her four books of poetry, her one novel, and certain of her critical writings, and indicates her influence.

The basic sources of information used include the extensive Tietjens Collection and the Midwest Writers Collection located in the Newberry Library of Chicago; genealogies and family histories now in the possession of Mrs. Chester Hart; conversations and correspondence with relatives, friends, and literary contemporaries of Eunice Tietjens; and Eunice Tietjens' works, both published and unpublished.

This study contains eleven chapters and follows a chronological organization. Chapter I discusses Mrs. Tietjens' heritage, youth, and first marriage. Chapter II investigates her literary apprenticeship and analyzes her relationship with leading writers of the Mid West. Chapters III-VI examine Eunice Tietjens' travels, World War I experiences as a journalist in France, first two books of poetry: *Profiles from China* and *Body and Raiment*, and her only novel, *Jake*. Chapters VII-IX deal with her editorship of *Poetry: A Magazine of Verse*, her periodical writing, her second marriage and further travels, and her final books of poetry: *Leaves in Windy Weather* and *Profiles from Home*. Chapter X treats her later critical articles and suggests her literary influence. Chapter XI brings the study to a close with a consideration of her last publications and further biographical details.

Eunice Tietjens' literary contributions are wide in scope. Her output consists of periodical articles, one novel, four books of poetry, fiction published serially in periodicals, a book of memoirs, text books, an anthology of Oriental poetry which was the first of its kind, encyclopedia articles, translations from French and Spanish literature, a Broadway play of which she was co-author with her husband, books for juveniles, and a long epic poem. Although she had fourteen books published, her first two books of poetry are her best works.

The study revealed the following: although Eunice Tietjens was not a major literary figure, nevertheless through her experimentation with new forms, diction, and subjects, through the influence of the poetry section which she conducted for the *Los Angeles Graphic*, and through her connection with *Poetry: A Magazine of Verse*, a connection which lasted almost continuously from 1913 until her death in 1944, Eunice Tietjens was an important figure in promoting the "new poetry movement." Her first book, *Profiles from China*, is historically important in connection with popularizing the Imagist movement. Her defense of free verse and her encouragement of a return to the primitive valuation of the melodic encouraged the new movement as did her insistence on ignoring the necessity of the ethical viewpoint and on permitting the poet freedom of choice in diction and subject matter. Although encouraging technical perfection, she felt that everything should be subordinated to spiritual sincerity.

This is the study of a worthwhile life, which, though literarily of most importance because of its influence upon other writers, is of absorbing interest within itself.

Microfilm \$4.90; Xerox \$17.35. 384 pages.

THE NOVEL OF ACADEMIC LIFE IN AMERICA

(L. C. Card No. Mic 60-5139)

John Ormsby Lyons, Ph.D.
The University of Florida, 1960

This study of novels about students and professors is an attempt to answer several questions concerning the history of higher education and the history of the novel. The discussion is based upon a bibliography of 193 novels from Hawthorne's *Fanshawe* (1828) through 1959. Three-fourths of the novels were published after 1925.

Before the First World War American novels of academic life combine a sentimental and genteel romance with campus high jinks. Such novels are often imitations of English town and gown fiction. The earliest significant departure is Flandrau's *Harvard Episodes* (1897), which introduces the question of democracy among the students but continues the essentially Romantic and anti-intellectual attitude that a student's real education is gained from contact with his fellow students and with Nature. Owen Johnson's *Stover at Yale* (1912) adds the thesis that this education can come from football and summer work.

F. Scott Fitzgerald's *This Side of Paradise* (1920) begins a fashion for novels about academic life which continues to the present. During the nineteen-twenties the main intent is to expose the excesses of undergraduates. The novels about women's colleges present the view that the girls' misdemeanors are mainly caused by the repressive attitude of the college authorities.

During the nineteen-thirties the college novel focuses on the problems of a sensitive, often artistic, young hero in an alien setting. His problem is not to find identity with the undergraduate society, as it was before the First World War, but to discover how he can be independent. These novels share many qualities with the traditional *Bildungsroman*, for the hero must both survive fleshy temptations as well as grow to reject the sterile pedantry of the academy. Among others, the early novels of Thomas Wolfe illustrate this theme.

Novels about undergraduates criticize the college curriculum because it is unrelated to the business of living. The novels about professors criticize the college curriculum because the old Classicism has given way before popularization, lower standards, and professional education. There are few instances in which novels of either type reveal a thorough knowledge of the history and problems of higher education. The criticisms in the undergraduate novels tend toward invective and sarcasm; those in the novels about professors toward lighter forms of satire. The important novels about professors include Willa Cather's *The Professor's House* (1925), Robert Herrick's *Chimes* (1926), and Wolfe's *Of Time and the River* (1935). The many lesser novels about professors tend to be cluttered with the stereotype of the professor as an absent-minded, uxorious, pedant, or a vicious, back-biting philanderer.

Novels concerned with academic freedom are always as cautiously liberal in their view as Thurber and Nugent's *The Male Animal* (1940). The argument for academic freedom is usually made by pitting a sincere and unjustly accused professor against an overly cautious president and reactionary board of trustees. The most mature treatments of this theme are Mary McCarthy's *The Groves of Academe* (1952) and May Sarton's *Faithful are the Wounds* (1956).

In recent years novels about undergraduates tend to display a concern with theme and form whereas formerly they were unselective accounts of the hero's four college years. William Maxwell's *The Folded Leaf* (1945), Shirley Jackson's *Hangsamen* (1951), and Charles Lumbard's *Senior Spring* (1954) illustrate this tendency. The recent novels about professors, such as Robie Macauley's *The Disguises of Love* (1952) and Gladys Schmitt's *A Small Fire* (1956), tend to avoid the stereotype professor and to be less episodic than such novels have been in the past.

Microfilm \$4.80; Xerox \$16.90. 374 pages.

GARCÍA JIMÉNEZ DE CISNEROS:
A PRECURSOR OF
SPANISH CLASSICAL MYSTICISM.

(L. C. Card No. Mic 60-6742)

Marina Vargas Mapa, Ph.D.
Stanford University, 1960

García Jiménez de Cisneros (1455-1510) is a neglected figure in the history of Spanish Mysticism. The present investigation into the life, background, and works of this Benedictine Abbot is inspired by a conviction that in order to understand the development of the great mystics of Spain, much more complete information than has been available heretofore on the precursors of Spanish Mysticism, such as Cisneros, must be brought to the attention of scholars.

García Jiménez de Cisneros belonged to the same noble family which gave Spain one of its celebrated figures, Francisco Cardinal Cisneros. These two men, who were first cousins, belonged to the ancient religious Orders of St. Benedict and St. Francis, respectively. García entered, in his youth, the strict monastery of San Benito de Valladolid and occupied important positions in that community. In 1493, he was chosen to be among those monks who, crossing the frontiers of Castile, established strict observance in the famous monastery of Santa María de Montserrat in Catalonia. There he governed until his death a heterogeneous family of monks, hermits, secular priests, coadjutor brothers, and choir boys. For each of these categories he wrote separate Constitutions--works which show his abilities as an excellent administrator and spiritual director, and a true son of St. Benedict. In 1496 the Catholic Kings sent him on a diplomatic mission to France. This trip brought him into contact with northern spirituality, which greatly influenced his subsequent writings.

Of special interest are his two ascetical treatises, the *Directorio de las horas canonicas* and the *Exercitatorio de la vida spiritual*, both printed in 1500 at Montserrat. The first work is a short treatise of ten chapters which teaches the religious how to prepare himself for the Divine Office and how he is to be occupied during the psalmody. The *Exercitatorio* is a much longer work consisting of sixty-nine chapters divided into four parts. The first three deal with the Purgative, Illuminative, and Unitive Ways of Prayer. The fourth part, occupying half the book, treats of Contemplation. Although addressed to Benedictines, the *Exercitatorio* may be used as a manual of prayer for beginners who are not cognizant of the ways of spirituality but who wish to dedicate themselves to God in the contemplative state.

Order and practicality are the main characteristics of Cisneros' works. Moreover, he employed simple, homely images in his examples, and his style is marked by conciseness, simplicity, clarity, coherence, and originality. His use of language is interesting in that it well exemplifies the transitional trends of the age with regard to phonology, morphology, and syntax. By his paternal tone, Cisneros gives a sense of immediacy to his treatises, rendering them more conducive to reading and study, and, in the end, to the practice of his doctrines.

The *Exercitatorio* has its importance in Spanish devotional literature in that it anticipates, by its content and manner of presentation, many of the well-known mystical writings of the Golden Age. Its main contribution consists

in its being the first manual of methodical prayer to be published in Castilian. Its author, consequently, merits to be numbered among the most celebrated of the promoters of meditation in the modern sense of the word.
Microfilm \$4.60; Xerox \$16.20. 357 pages.

THREE "SPÄTROMANTIKER" ON ROMANTICISM:
HOFFMANN, HEINE, AND EICHENDORFF.

(L. C. Card No. Mic 60-6308)

Robert Russell Mollenauer, Ph.D.
Indiana University, 1960

Supervisor: Professor Norbert Fuerst

This dissertation investigates the direction in which three German "late" Romanticists continue the theoretical interpretation of the concept "Romanticism." The first chapter reviews the previous history of the term--guided by Ullmann's and Gotthard's *Geschichte des Begriffes 'Romantisch' in Deutschland (1927)*--from the original confluence of "das Romanhafte" and "das Landschaftliche," then to the specialization of the "Hochromantik."

E. T. A. Hoffmann became a Romantic theorist when he turned music critic (for the *Allgemeine Musikalische Zeitung*). His early review of Beethoven's Fifth Symphony (1810) gave him the opportunity to formulate his ideas, and the result was: Romanticism is music. As a drama critic he was induced to incorporate also Calderon, Shakespeare, Goethe in the widening concept. Soon Catholicism, chivalry, the fantastic, dreams, love, opera as a whole were embraced by the term. Many of the review articles were later fused into the fictional medleys, especially the *Serapionsbrüder*. "Serapionism" is a Hoffmannesque Romanticism; but the interpretation becomes more and more vague.

Heine the critic and Heine the poet strike widely divergent attitudes toward Romanticism. *Die Romantische Schule* (1833) is really a series of witty pamphlets against the movement, which is promptly defined as the rebirth of the literature of the Middle Ages. Romanticism consists of irreality and absurdity, it means mysticism, Catholicism and feudalism. It is in opposition to progress, form, reason, intellectual freedom, and social liberty. This accretion of lethal diagnoses is scattered between penetrating, often intuitive, and always amusing portraits of the individual Romanticists. In Heine's poetry, however, especially in *Atta Troll* (1841), his definitions of Romanticism were tender and almost nostalgic. In the end Heine was pleased to call himself a "Romantique défroqué."

Eichendorff combined Hoffmann's enthusiasm for Romanticism (as an ideal) and Heine's criticism of Romanticism (as a realization); but our hope of finding the synthesis in him was frustrated. His *Geschichte der poetischen Literatur Deutschlands* (1857) is closer akin to Heine's methods, except that his value judgments are diametrically opposite. He sees in early Romanticism the potentialities of a radical regeneration, political, spiritual, and especially religious. In the next generation of Romanticists he discerns the dangers of irony, pantheism, nationalism, and the fantastic. Finally Romanticism disintegrated into split personalities, materialism, and mere masquerade.

Not unlike Heine, Eichendorff distributes these discussions between characterizations of individuals that are often warm and gripping.

As mutual critics Hoffmann, Heine, and Eichendorff demonstrate rare insight and fairness. However, their theoretical opinions proved to be incommensurable. Their extreme individualism permitted no common doctrinal agreement. Thus, as far as this investigation goes, a historical consolidation of the definition of Romanticism was not achieved by the "Spätromantiker." Their individual efforts, to be sure, in each case bear the stamp of genius and deserve the increasing attention which these theoretical writings have gained in our time.

Microfilm \$2.75; Xerox \$7.80. 167 pages.

THE WORLD OF MALGUDI:
A STUDY OF
THE NOVELS OF R. K. NARAYAN.

(L. C. Card No. Mic 60-5923)

Nirmal Mukerji, Ph.D.
Louisiana State University, 1960

Supervisor: Professor John Hazard Wildman

The object of the present study is to analyse and evaluate the achievement of R. K. Narayan as a novelist. A contemporary Indian writer, he has created the South Indian small town of Malgudi as the locale for his fiction. This dissertation analyses and interprets the life portrayed in this town, distinguishes the author's approach to Indian life from that of some prominent Western writers whose works center on the same theme, and evaluates the significance of Narayan's contribution.

Chapter I deals with the setting of Narayan's fictional world. The town of Malgudi is small, old, shabby, and extremely unassuming, but it is real--it is India as seen by one who belongs to it. It is entirely different from the romanticized version of India with which a Western reader is usually familiar. Narayan's setting is appropriate and authentic, and it contributes toward a better and deeper understanding of the life of his people. This strong sense of place with which the Malgudi novels are imbued helps in establishing a feeling of solidity, reality, and intimacy.

In these novels Narayan presents a cross-section of Hindu middle class society. An attempt is made in Chapter II to study these people as they are pictured by the author. The most striking characteristic about Narayan's people is that they are strongly tied down to deeply rooted traditions, but the impact of Western ideas on them is no less decisive. Ironically enough, they can neither willingly accept nor completely reject the new patterns of life, and this attitude places them in recurrent states of indecision and confusion. Within the general framework of the age-old traditions Narayan studies the lives of such people.

The third chapter traces the development of Narayan's art with particular reference to such problems as structural organization, point of view, and time-sequence. A study of his novels arranged chronologically has revealed his literary development from the chronicle-type of plot structure of *Swami and Friends* to the well-integrated, dramatic, and organic structure of *The Guide*. His plots usually rely

heavily on central characters. Although English is not Narayan's mother tongue, he writes in it with an ease which is amazing. His prose style is simple, clear, moving, and forceful.

Chapter IV studies the attitudes of the novelist as revealed in his novels. The question of the freedom of the individual is considered in the light of such basic and fundamental concepts of Hindu thought and ways of life as *Dharma*, *Karma*, and *Varna*. It is found that his general attitude toward social and religious institutions is that of trust tempered by criticism. He conceives of life in the spirit of comedy, but it is not the hilarious and boisterous type of comedy; it has undertones of sadness. His satire is directed more against individuals than institutions. On the whole, it is very gentle. His irony which is his most serviceable weapon has a flavor all his own. He knows well the value of reticence. Nowhere do we find over-explicit and pronounced moral judgments. He does no harm to the illusion of the life he creates. His moral values are implied rather than stated.

The creator of the world of Malgudi is a novelist with a growing reputation. Narayan is rightly considered to be the most significant contemporary novelist of Indo-Anglian literature. For a faithful and intimate portrayal of Indian small town life and for creating a world which is very much alive, he deserves a wider recognition.

Microfilm \$3.10; Xerox \$10.80. 238 pages.

CONTEMPORARY MEXICAN THEATER.
1923-1959.

(L. C. Card No. Mic 60-6630)

Marianne Oberdoerffer, Ph.D.
The University of Texas, 1960

Supervisor: Dr. J. R. Spell

Whether in Mexico there is a group of works and a continuous production that merits this general term of contemporary theater is a question that has been asked many times. Often it has been answered negatively, not only by foreign critics interested in the development of Mexican literature but by many Mexicans themselves, including people working for and connected with the theater. The answer to this question would seem to depend first of all on the point of view from which it is derived. If one looks merely at the quantity and the diversity of works produced in the last thirty to forty years, one cannot deny the existence and a certain vitality of the theater. If, on the other hand, one dissociates quantity and quality, admitting esthetic value as the only basis for judging whether there is a significant theater, the affirmation might be made less readily. Upon closer examination of the material, however, it must be conceded that individual works and general trends do attest activity in the field of dramatic art that cannot be disregarded in a general survey of the country's literary accomplishments.

The purpose of this study is to appraise the Mexican theater and to show how drama and comedy reflect the ideas, attitudes and tendencies of a certain period. At times they are universal; but many find their origin in the particular environment of this country and its people or

in their traditions and problems. One chapter traces the historical development of the theater during the years 1923-1959, and three chapters are devoted to the discussions of plays, covering the years 1923-1939, 1940-1949 and 1950-1959 respectively. Since the emphasis of the study is on themes, each chapter contains separate thematic subdivisions. The year 1923 has been chosen as a point of departure because it was then, for the first time, that a theatrical season was organized with a frankly nationalistic intent, and more Mexican plays were presented than in previous years. The year 1939 brought to a close the work of the first professional and experimental groups interested in the reorientation of dramatic activity. Early in the decade beginning with 1940 a new era of experimental groups starts and by 1950 the theater has outgrown its experimental stage. An unprecedented number of new authors now begin to devote themselves professionally to the theater. By dividing the chapters into three chronological groups it was possible to show the thematic development of the theater: its gradual change from the treatment of problems peculiar to the Mexican scene to topics of universal interest and significance.

Few plays of the first period, covering the years 1923-1939, can be considered of lasting interest; their importance is mainly historical, in so far as they reflect the main trends of thought, preoccupations and tastes of the writers. However, two outstanding dramatists make their appearance during that time: Rodolfo Usigli and Celestino Gorostiza whose works constitute a valuable and lasting contribution to the Mexican stage.

The decade 1940-1950 is a transition period with a relatively meager dramatic output, but it produced one of the most important Mexican playwrights: Xavier Villaurrutia. His dramas, apart from the brilliance of composition, are significant for the fact that they are based on general problems of human relations, not restricted to time or place, which gives them a universal scope.

The most interesting period of the Mexican theater begins undoubtedly in 1950, bringing to the fore a great number of new authors reflecting a diversity of trends and presenting new topics. In many plays no longer concerned with local problems a universal quality is inherent. Two of the most important playwrights of the young generation are Luisa Josefina Hernández and Emilio Carballido.

An evaluation of the dramatic activity during the period 1923-1959 leads to the conclusion that in Mexico there is a contemporary theater of interest and value.

Microfilm \$3.15; Xerox \$11.05. 244 pages.

STRUCTURAL PATTERNS IN THE REPERTORY OF THE CHILD ACTORS THROUGH 1591

(L. C. Card No. Mic 60-4858)

Rosamond Putzel, Ph.D.
The University of North Carolina, 1960

Supervisor: Ernest W. Talbert

During the rapid development of English drama in the sixteenth century, the most prominent groups of actors were boys, at Paul's and the Chapel Royal, at Eton,

Westminster, and other schools. Their supremacy began to wane after permanent professional theaters were built, but their importance continued until 1591, when they were temporarily banned from London stages. Though the child actors' pre-eminence in those years cannot be disputed, relatively few extant plays can be ascribed to their repertory with certainty. On the evidence of direct statement in the earliest texts, these productions were given by boys: Jack Juggler, Tom Tyler and His Wife, *Respublica*, *The Bugbears*, *Damon and Pithias*, *The Arraignment of Paris*, *The Wars of Cyrus*, *The Tragedy of Dido*, and John Lyly's plays. On the basis of their casts and their contents, there is strong probability that these plays also were done by children: *Youth*, *Thersites*, *Lusty Juventus*, *The Disobedient Child*, *Nice Wanton*, *Jacob and Esau*, and *Ralph Roister Doister*. For other plays which have sometimes been ascribed to boy actors, there is insufficient evidence.

A study of these plays reveals several facts about the structural development of English drama: that basic structural patterns changed and multiplied enormously during those years, that continuity was maintained in traditional English songs and comic themes, and that there was a strong predilection on the part of later authors for subject matter from classical narratives and mythology. The earliest plays, before the middle of the century, were of two kinds: loosely built farces like *Thersites*, designed primarily for extempore comedy; and double-conflict moralities like *Youth*. In the 1550's, a new pattern came into use -- the five-act pattern which T. W. Baldwin has shown to have derived from analyses of Terence, and which established a practice for allocation of plot materials to certain acts. *Respublica*, a transitional play, combined morality form with five-act form. *Ralph Roister Doister* and *The Bugbears* imitated not only the structure but characters and plots of Roman plays.

Subsequent plays in the repertory, with one exception, use classical subject matter, and all of them are five-act plays. They show, however, a variety of experiments in form, and they do not always follow the Terentian theoretical structure. *Damon and Pithias*, not divided in its early edition, still demonstrates its author's knowledge of five-act form. *The Tragedy of Dido* is very close to the Terentian pattern. *The Arraignment of Paris*, though it has five acts, almost entirely ignores Terentian structural theory because its purpose of complimenting Queen Elizabeth leads to use of techniques from "royal entry" and "royal progress" entertainments. The five acts of *The Wars of Cyrus* are no more than divisions of acting time, irrelevant to dramatic form because the plot is not unified.

John Lyly's first five plays (*Campaspe*, *Sapho and Phao*, *Gallathea*, *Loves Metamorphosis*, and *Endimion*) show steady progress in the techniques of uniting two or more plots in a single five-act drama. At first he relied upon the Terentian pattern and his subplots were undeveloped episodes loosely connected with the main plot. Later, especially in *Endimion*, the pattern altered, and the subplot became a complete action integrated with the major story. In Lyly's last three plays, he experimented with forms and techniques popular twenty years earlier. *Mother Bombie* is an imitation of Latin comedy, as was *The Bugbears*; both *The Woman in the Moon* and *Midas* employ stylizations characteristic of moralities, using, however, an episodic structure.

Continuity is demonstrated in the boys' repertory by

use of songs and comic themes in the English tradition. The vices of moralities joined with comic servants of Roman comedy to create a type of character which developed into Lyly's witty page boys. Comic monologues and songs retained the themes of drinking, mockery, gluttony, and the woes of servants. Comic techniques continued to embody a great deal of verbal humor. Songs in the later plays often, though not always, served the same structural functions which they had in moralities -- to end scenes, or to enliven roistering scenes.

Though few of these characteristics are found solely in plays for child actors, the prominence of the children's troupes in the sixteenth century indicates that their repertory was a major field for experiment and development of English dramatic structure. They had greater stability as acting groups than had adult companies, and they were granted greater facilities for production by royal patrons for whom they often performed.

Microfilm \$3.10; Xerox \$10.80. 238 pages.

STUDIO ESTETICO-COMPARATIVO SUL
ROMANZO PASTORALE:
SANNAZARO E LOPE DE VEGA.
[Italian Text].

(L. C. Card No. Mic 60-6086)

Michele Ricciardelli, Ph.D.
University of Oregon, 1961

Adviser: Perry J. Powers

The modern critics seem to think of the pastoral novel as a literary fashion which has passed away, without meaning for the modern reader. They usually speak of this literary tradition in Spain as an imitation of the *Arcadia* of Jacopo Sannazaro, which reaches perfection in the *Diana* of Jorge de Montemayor. Therefore they give no importance to the other pastoral novels posterior to the *Diana*. In particular, when they arrive at *La Arcadia* of Lope de Vega, the critics not only do not understand its great importance and artistic originalities, but also condemn it as a work of cold erudition and of servile adulation.

This thesis which is primarily an aesthetic study of Lope's work in direct relation to Sannazaro's work, showing the artistic qualities and beauties of *La Arcadia*, intends to be a reaction to critical opinion and an attempt to reevaluate this pastoral novel.

Montemayor is undoubtedly very important in the pastoral novel, but he is far from being perfect. Therefore the three chapters of this thesis on the *Diana* of Montemayor, the *Diana enamorada* of Gil Polo, and the *Galatea* of Cervantes, have the purpose of showing not only their relation to Sannazaro and Lope, but also of pointing out their important changes and their artistic value. We study them as a significant whole within that pastoral tradition started by Sannazaro. We do not look at their imitations of Sannazaro or of each other, but we are only interested in evaluating their characteristic originalities and literary beauty. Since Lope, the last novelist of this tradition, states explicitly his intention to return to Sannazaro, a study of the three above mentioned novels should demonstrate more clearly the significance and interest of the art of *La Arcadia*.

The pastoral novel presents an ideal world of dreams, desires, and aspirations, where the shepherds, living among the beauties of nature, seek a mate for the happiness of their lives. Hence the principal problems involved in this thesis are the place, the role of the authors and characters, the women and consequent misogyny, and love.

Sannazaro's world is located in the classic *Arcadia*, where the author escapes because of the great suffering of not being loved by his Carmosina. His name is Sincero and he lives as a shepherd among shepherds. In their sorrows and invocations of love, and in the surrounding nature, Sincero sees reflected his own sorrows and desires of love. In the middle of his novel, the author identifies himself with Sincero, tells why he came to *Arcadia*, and relates his sad story. Author and protagonist are the same person.

Lope's world is the same *Arcadia*, which is not a world of escape, but a world of its own where the shepherds are born and spend their existence. The protagonist is Anfriso, whose story the author relates, in spite of the fact that in him Lope sees and weeps his own misfortunes. In this *Arcadia* we meet a shepherd from Spain, called Belardo who, at the end of the novel, appears to be the author. The author seems to play the role of a spectator in what he calls the "theater of his history."

In Sannazaro the women are only described and ardently desired. They do not act, and except for Amaranta, do not appear on the pastoral stage. In Lope they live with the shepherds and want to be loved. They must have not only that superlative physical beauty of Sannazaro's women, but they must also possess spiritual, inner qualities and virtues.

In the Italian novel we have one particular case of misogyny, which becomes general in the pastoral world of Lope, where the women are shown with their virtues and their human weaknesses.

Love, for both authors, starts from the beauty of the women and tends to possession, with a natural union in Sannazaro and with marriage in Lope. Since love is the basic reality of the pastoral world the result is that everything the shepherds do is connected with love. In Sannazaro love is not action, but desire and aspiration; in Lope, because of the appearance of the women, it becomes action and struggle. Both men and women fight for the conquest of love. Since in Lope several men can desire and strive for the possession of the same woman, love can become illicit or impossible, which is what happens to the protagonist Anfriso. At this point the great meaning of Lope's arcadian world is made clear: the purification of man through *desengaño*. This *desengaño*, which constitutes also the continuous aspiration of the young author, enables man to substitute love of virtue for love of woman.

The many artistic innovations, the strong contrast between the need for love and the aspiration toward virtue, the natural psychology of different characters in their search for love, magnificent descriptions united with a superb ciceronian prose and the beauty of great poetry, show how wrong the critics of *La Arcadia* are and how important the literary value of Lope's work is, coming at the end of the pastoral tradition in Spain.

Microfilm \$4.50; Xerox \$15.75. 349 pages.

SEAN O'CASEY:
THE MAN WITH TWO FACES.

(L. C. Card No. Mic 60-3298)

Ronald Gene Rollins, Ph.D.
University of Cincinnati, 1960

Sean O'Casey, Ireland's greatest living playwright, is a dynamic, enigmatic Irishman who is something of a lyricist and a realist. This dissertation proposes to accomplish a definite interpretation of O'Casey's complex genius, demonstrating how the previously unrecognized dichotomy in his mind and temperament has determined the unique character of his dramatic art. One cannot wisely, however, discuss O'Casey's dualistic nature in isolation; the dissertation, while pointing out the antithetical tensions in both O'Casey and his drama, examines, therefore, the experimentations in form, and the variations in theme, character and language in this Irishman's drama; evaluates O'Casey's relationship with notable literary figures like George Bernard Shaw, Lady Augusta Gregory, William Butler Yeats and Lennox Robinson, and the Abbey Theatre; and points up O'Casey's incessant concern with the relationship that should ideally exist between man and certain social forces and institutions.

O'Casey's quixoticism--the discord between his realistic and lyric inclinations--is decidedly in evidence in his first three Dublin proletarian tragedies which, while studying man's role in an ever-expanding social unit, display the demoralizing effects of social disorder upon private destinies. His realistic bent gives these works their carefully-contrived plots, their fully-delineated characters and their numerous low comedy scenes rich in overtones of acrid, Celtic laughter. His lyric spirituality, on the other hand, produces the eloquent dialogue and the pathos and restrained feeling that attends, indeed envelops, the moments of tragic intensity. Operating together, O'Casey's dual tendencies join riotous comedy and grim tragedy, and mingle a Hogarthian frankness with a Chekovian tenderness.

The divided halves of O'Casey's selfhood continue to fluctuate in a point counter-point fashion in his experimental, transitional plays which continue O'Casey's probing into the antagonism between man and the impersonal force of war (*The Silver Tassie*), organized religion (*Within the Gates*), the state (*The Star Turns Red*), and labor unions (*Red Roses For Me*). O'Casey's lyric urge accounts for the chanted dialogue, the stylized stage decor, the music, the copious symbols and the aureole of associations that surround the formal design of these plays, especially *The Silver Tassie*, *Within the Gates*, and *The Star Turns Red*. His practical bent gives these works their skeletal design, their linkage between scenes, their consciously-manipulated major and minor plot complications and their undercurrent of stinging ridicule.

O'Casey is still the singing Celt and the angry realist in his final censorious fantasies which, while commingling the realism of the Dublin proletarian tragedies with the abstractionism of the middle plays, discuss man's relationship to massed military might (*Oak Leaves and Lavender*), and the formal church (*Cock-A-Doodle Dandy* and *The Bishop's Bonfire*). The Irish dramatist's penchant for unworldly dreaming produces the abundance of song, poetry, abstract figures, symbolic stage trappings and tragic poignancy in these works. His practical skill controls the flexible plots, the retrospective exposition, the entrance and

exits of characters and the moments of sardonic comedy. Balanced against each other, O'Casey's twin talents result in a drama distinguished by its flexible design and its mood of gay but thoughtful detachment.

With his two faces, O'Casey, then, produces a synthesis that is rare in dramatic literature. His keen powers of observation result in his documentary realism, but his Celtic literary imagination often determines the final interpretation. The vitality and distinctiveness of his dramatic artistry stem, therefore, from his adjustment of common realities to his poetic vision. His works--arguing for a free and rich personal life in opposition to any repressive convention--emerge, then, as the distillation of lyricism from the rock and mortar of proletarian existence.

Microfilm \$3.60; Xerox \$12.60. 280 pages.

THE REPUTATION OF EMERSON
IN BRITISH PERIODICALS FROM 1840
THROUGH THE TURN OF THE CENTURY

(L. C. Card No. Mic 61-307)

William Jacob Sowder, Ph.D.
University of Kentucky, 1956

Director: Dr. Hill Shine

In tracing Emerson's reputation in British periodicals from 1840-1903, I have abstracted some 320 articles, reviews, and notices which appeared in 115 different periodicals. (Nearly all of these journals can be found in the Library of Congress.) In addition, I have pointed out political, religious, and philosophical biases in the periodicals (where there were any) and have indicated how these biases affected criticism of Emerson. Thirdly, I have noted trends in periodical literature as well as those in the fields of politics, religion, and philosophy and have attempted to show how they helped to bring about a change in Emerson's reputation.

This reputation can be conveniently divided into three periods. The first of these is that during which Emerson was producing his most creative work. This period extends from 1836 (when *Nature* appeared) to 1867 (when *May-Day and Other Pieces* was published). Emerson's first notice in English periodicals came in 1839, at which time he was mentioned in the *London and Westminster Review* as the author of *The American Scholar*. The first long review of the American's writings appeared also in the *Westminster* in 1840. The following six or seven years found Emerson still relatively unknown. In 1847-1848, however, he made an eight-month's lecture tour of Great Britain and during that time came into a wide, though not popular, reputation. Periodical literature during those early years was interested more in castigating the American's political, religious, and philosophical views than in according him disinterested criticism. Disinterested criticism did not begin to appear on Emerson until the middle and late 1860's when writers like John Nichol and Moncure D. Conway published on him (in the periodicals) certain biographical and critical monographs which went far toward his firm establishment as a man of letters.

During the second period of Emerson's reputation in English periodicals--that of 1870-1881--he wrote nothing

of major importance. His two collections of essays--*Society and Solitude* (1870) and *Letters and Social Aims* (1875)--were taken in the main from a reserve that went back as far as the late 1830's. Neither did his miscellaneous publications during the period amount to anything. Thus the diminishing vigor of his own creative efforts plus a general apathy which pervaded the whole critical field account perhaps for the fact that Emerson's reputation in the seventies was at ebb. Only a few biographical and critical articles and reviews appear on him and his works: none of them was at all distinguished.

The third period of Emerson's reputation in English periodical literature begins with his death in 1882 and ends with the publication of the *Centenary Edition* in 1903. The first eight or nine years of this period found Emerson's reputation rising to new heights. For during this period the finest critics of the late nineteenth century--Matthew Arnold, Henry James, W. L. Courtney, and George Saintsbury among others--published articles on him in the finest journals of the day. In addition such excellent biographies (books) as those by James E. Cabot and Oliver W. Holmes appeared on him. These books brought forth a large number of reviews. After such activity a reaction was bound to set in; therefore during the nineties Emerson's reputation was not so great as it had been in the earlier decade. In 1903, however, the centennial of the American's birth was celebrated, and during that year, Edward Waldo Emerson brought out the first volumes of the definitive edition of his father's works. This fine edition along with the general excitement over the celebration of the hundredth birthday again focused attention upon Emerson. Although this attention was not as wide as it had been in the eighties, it was ample enough to assure Emerson at the turn of the century a high place among the best writers of the age.

Microfilm \$5.40; Xerox \$19.15. 421 pages.

THE AMERICAN CRITICS OF HENRY JAMES:
1864-1943.

(L. C. Card No. Mic 61-308)

William Talmadge Stafford, Ph.D.
University of Kentucky, 1956

Directors: Dr. Herman E. Spivey and Dr. John Cutler

Henry James and his writing represent the most extensive, the most difficult, and the most complex critical challenge any American writer has ever embodied. By 1943, the centennial of his birth and only twenty-seven years after his death, American criticism had met that challenge with a larger number of its best critical minds, with a greater amount of its best literary criticism, than it had devoted to any other native author. To examine the quality of James's American reputation is thus to examine the quality of American criticism itself.

James's contemporary critics, most often those who were also creative writers like himself, performed the important task of accurately defining most of the major critical and scholarly problems his writing entailed. They assigned to James positions of importance in the histories of American literature which were then first being written.

And they helped make available the best publishing outlets America had to offer for every word James wrote.

During the next fourteen years (1916-1929) American critics devoted to the novelist two book-length studies of his technique, a book-length study of his literary criticism, a book-length "life" of his value as a national cultural symbol, and the entire issue of a magazine edited and contributed to by two of America's most distinguished and influential poets. These studies, with others, of James's most original artistic innovations -- his technique and his literary criticism -- led to an understanding of how his morality was conditioned by his technique and how his technique had itself been conditioned by his dramatic experiments. And thus was introduced the rewarding critical habit of studying the whole James. In addition, American critics made available many new facts about the novelist's life. They introduced Freudian methods into the examination of James's fiction. And they devoted, on an even larger scale, important estimations of James's general worth in the period's ambitious literary histories.

From 1930 through 1943, the critical accomplishment was still greater. During that period American critics wrote thirteen separate books either wholly or almost wholly devoted to James or members of his family. Three magazines gave over entire issues to the novelist, and two others ran series of articles commemorating his centennial. Nine different poets paid him tribute in verse or wrote appreciative articles about him. Scholars produced definitive bibliographies of both James's own writing and writings about him. They unearthed a still larger mass of information about his life; made even more detailed studies of his drama and literary criticism, his critical Prefaces, and his literary sources, parallels, and influences; and began the enormously difficult task of assessing the general impact of James's technique on modern fiction. Most importantly of all, in devoting a mass of material to James's social worth, they began to see new aspects of his American worth; for his moral worth, it was maintained, was no less conditioned by his nationalistic affinities than by his technical concepts.

By 1943 American critics had thus come to practice on a wide scale the critical principles Henry James preached. In so doing, they paid the novelist the highest tribute possible. And in so high, so early, and so widespread a tribute, they also paid high tribute to themselves.

Microfilm \$4.45; Xerox \$15.75. 347 pages.

THE INFLUENCE OF THE MORAVIANS
UPON THE LEATHER-STOCKING TALES

(L. C. Card No. Mic 60-5506)

Edwin L. Stockton, Jr., Ph.D.
The Florida State University, 1960

Seeking reliable information about the North American Indians for *The Leather-Stocking Tales*, James Fenimore Cooper consulted the works of the Moravian missionary John Gottlieb Ernestus Heckewelder (1743-1823). From reading Heckewelder's *An Account of the History, Manners, and Customs of the Indian Nations* (1819) and *A Narrative of the Mission of the United Brethren among the Delaware and Mohegan Indians, 1740-1808* (1820), Cooper learned not

only about the Indians but also about the Moravians. Interested in the work of the Moravian missionaries among the Delawares, he modeled Chingachgook after Heckewelder's friend Mohican John, who, like Chingachgook in *The Pioneers*, had been baptized by the Moravians. To Natty Bumppo, Cooper gave the wisdom and moral character of the Moravian missionaries. Because Natty so often referred to the Moravian doctrine, his frontier friend Harry March remarked: "I . . . believe you are at heart a Moravian. . . ."

It is ironic and also unjustifiable in view of the evidence here presented that scholars have praised Cooper's characterization of Leather-Stocking as a frontier moralist but have severely criticized the novelist for portraying the Indians as having "the soul, reason, and characteristics of a fellow being." Writing for *The North American Review* in 1826, General Lewis Cass, Governor of Michigan Territory, voiced his resentment of Cooper's portraying any of the nobler aspects of the undefiled Indian race of the eighteenth century. Also, irritated by the novelist's criticism of backwoodsmen who practiced exploitation and revenge instead of the Moravian principle of brotherly love toward the Indians, General Cass undertook to disparage Cooper's characterization of the red man by saying that the novelist's Indians were creations of his imagination and had no living prototypes in the forests.

Since 1826, literary critics have found it much easier to repeat General Cass's unwarrantable remarks about Cooper's Indians than to collate the novelist's tales with Heckewelder's works to discover that Cooper followed his historical sources with remarkable fidelity. Therefore, this study proves that whereas Cooper may be considered a romanticist when he was inventing his plots, he was a realist when he was writing about the red man in *The Leather-Stocking Tales*.

The influence of the Moravians, through the *History and Narrative* of the veteran missionary John Heckewelder, is threefold: (1) providing Cooper with authentic information about the manners, customs, history, and traditions of the Indians, (2) furnishing him with religious doctrine and moral precepts for his reader's edification, and (3) suggesting to the novelist poignant arguments for reforming the American public's attitude toward the Indian.

Microfilm \$2.90; Xerox \$10.15. 224 pages.

GEORGE ELIOT'S IDEAL SELF:
A STUDY OF SUBJECTIVE INFLUENCES
ON HER PROSE FICTION.

(L. C. Card No. Mic 60-6153)

Houston Clay Tucker, Ph.D.
Vanderbilt University, 1960

Supervisor: Professor Edgar H. Duncan

George Eliot's correspondence indicates that three important concerns of her life were (1) her sense of dependence and her natural subjectivity, (2) her ethic, and (3) her theory of fiction. This thesis holds that these three concerns inform George Eliot's novels to the extent of giving essentially the same direction and meaning to all her fiction.

The nature of the three concerns and their chronological development are traced in George Eliot's letters. The results of this examination are then applied to an analysis of *Scenes of Clerical Life* and her seven novels. Although each work of prose fiction is considered separately and with respect to its special problems, the subjective influences indicated by the three major concerns are found to affect George Eliot's characterization, theme, and artistic purpose in a similar way in all her works.

In the broadest sense George Eliot's characters fall into three groups: (1) minor characters that provide color and atmosphere, (2) major characters that are punished for their sins, and (3) major characters that are ideal figures. Groups (1) and (2) are, for the most part, realistically and objectively drawn. Group (3), the most important, contains her leading figures, those that embody the author's ideals, illustrate her moral conceptions, and undergo struggles that are in accord with her ethic. These figures are subjectively drawn. Most of them begin their struggles in selfish delusion and must submit to an educative process which brings them to the ideal state. This group contains the imposing list of heroines beginning with Caterina in "Mr. Gilfil's Love-Story" and ending with Gwendolen in *Daniel Deronda*. Each of these heroines is a subjective creation having in some way an identification with the author herself. There are some idealized heroes in the group who, like the heroines, reflect the author's tendency to project herself into idealized characters. The author's acute need for others, her sense of renunciation and duty, and her desire for self esteem, all of which are elements of the sense of dependence indicated in the letters, inform the major characterizations in the prose works. The influence begins early and continues through her entire work.

The experiences of the main characters are explications of George Eliot's theme, a theme which is essentially the same throughout her fiction. The theme is always that human sympathy is the great good and that it is to be embraced by renunciation of self and a satisfactory adjustment of the individual to his social milieu. In her fiction George Eliot exhibits consistently a deterministic sociological view that is in accord with her own ethic. The characters live in a world that operates, as George Eliot believed it did, according to Bray's philosophy of necessity, Comte's melioristic sociology, and the latter's Religion of Humanity tempered by the views of Feuerbach and Hennell.

George Eliot believed that fiction should be morally instructive. There may be inadequacies in such a view, but the moral purpose of her esthetic theory is insisted upon in each of her works. The subjective influence of her own theory of fiction leads to didacticism, excessive idealization of some characters, poor plots, absence of variety among the main characters, and slow action.

This study concludes that her correspondence reveals a preoccupation with self that is evident in her sense of dependence, her aspiration for good, and her struggle to define her ethic. An idealization of these preoccupations occurs in her novels with such consistency and repetition that she is best considered as a novelist of ideas, and her total work is best understood as being unified on an ethical principle. Microfilm \$4.85; Xerox \$17.10. 379 pages.

SURREALIST THEORIES OF LITERATURE

(L. C. Card No. Mic 60-6333)

Fiorella Sirotti Turbeville, Ph.D.
Indiana University, 1960

From the many "isms" of the period between 1909 and 1925 the writer has selected five which seem most representative of European culture: Futurism, Expressionism, Activism, Dadaism, and Surrealism. The object of this dissertation is to offer a comparative survey and discussion of these movements and to point out the divergencies and similarities in their development and ideologies.

Futurism announced itself as a movement of youth against tradition and the past. It advocated the cult of progress, movement, and speed. The Futurists repudiated the concept of art for art's sake and proclaimed an art of enthusiasm and tension, in revolt against tradition, imitation, and the cult of form. They claimed that art must contrive to express simultaneously all of the different aspects of an object, that it must fix and reproduce the demon of speed, and that ultimately it must become an instrument for the transhumanization of man.

Expressionism was characterized by a contempt for the materialism of Naturalism as well as for the sensualism of Impressionism. This movement demanded a new spirituality in contrast to the scepticism and relativism of the age.

Its aim was to create an art of the future and to bring about such a future through violence and revolution if necessary. Expressionism was a movement against outward reality, aimed at improving existence through a grasp of inner, spiritual reality; it claimed an ethical and social reformation and believed in the mission of the artist as reformer of the world. The artist was claimed to be an absolute creator, capable of penetrating the phenomena of reality to the Essential and the Infinite.

Activism started as a branch of Expressionism. Later, however, political aims overshadowed artistic goals and ultimately political action was claimed to be the only function of literature. Finally the political ideals of Expressionism were carried to an extreme and the Activists espoused the cause of Communism.

Dadaism's main goal was the presentation of organized nonsense with the intention of shocking and irritating the public and of undermining its belief in the traditional values of society and of art. The Dadaists declared themselves against art, society, and all the values of civilization. Artistically the movement remained sterile. Many Dadaists later joined the movement of Surrealism.

Surrealism endeavored to shock the public into an awareness of a new reality beyond the world of practicality. This universe, which civilization and reason seem to hide from man, was to be investigated methodically by scientific techniques. Art was considered one of the instruments of this search for absolute values, the revelation of which could bring about the regeneration of man.

These five movements are seen as fundamentally related notwithstanding their ideological divergencies. They all shared these fundamental concepts: 1) the revolt of man against reality; 2) the intuitive and constructive vision of the artist; and 3) the necessity of shocking man into admitting the absurdities of his beliefs and of deranging the existing world in order to build a new one.

Microfilm \$2.75; Xerox \$7.80. 166 pages.

THE FATAL WOMAN
IN FRENCH LITERATURE
OF THE NINETEENTH CENTURY

(L. C. Card No. Mic 60-6998)

Albert Harlan Wallace, Ph.D.
The University of North Carolina, 1960

Supervisor: Dr. Alfred. G. Engstrom

This study is concerned with the appearance and importance of the fatal woman in the literature of France during the nineteenth century. It examines the various writings on the subject and seeks to demonstrate their relationship with earlier treatments. Reasons are suggested for the unusual popularity of the fatal woman during most of the century, and for her loss of prestige during the last decade of the period. It is felt that the detailed examination of the poetry, novels and plays dealing with the theme adds to insights already projected by more general studies.

The fatal woman is defined as one who brings about her lover's death or moral destruction; and she is not to be confused with the villainess or acquisitive female whose love is not fatal. A general survey of the literary history of the fatal woman serves as a preface to the study of her career in the nineteenth century. Beginning with the treatment of Lilith in Babylonian mythology, the study first traces briefly the appearance of the fatal woman in the Bible, in Greek literature, in Roman literature, in northern folk-legend and myth, in the medieval period, in the Renaissance, and in the post-Renaissance period before the nineteenth century. It is suggested that the recurrence of the fatal woman in literature is possibly related to the male subconscious which envisages the female as evil.

An examination of the fatal woman in books by such writers as Chateaubriand, Mérimée, Gautier, Balzac, and Dumas, to name only a few, affords evidence that her literary triumph after the publication of *Carmen* (1845) must be seen as related to earlier nineteenth-century works on the theme. Viewing the fatal woman's victory over the fatal man as logically prepared for by these earlier treatments, the present study suggests that her emergence as a dominant figure is as much the result of the male's subconscious apprehensions about the female as a manifestation of revolt against the fatal man. Further, the work of the authors concerned is seen as revealing a close attention to the development of a hero-victim; and the successful portrayal of this character throughout the century is in great part responsible for the longevity of the fatal woman's reign.

Carmen (Mérimée), *Cécily* (Eugène Sue, *Les mystères de Paris*) and *Conchita* (Pierre Louÿs, *La femme et le pantin*) and their victims are discussed in detail. *Cécily* is seen as representative of the type of fatal woman popular before *Carmen*, and *Conchita* as a type that becomes increasingly more important during the latter half of the century. *Carmen* is viewed as a sort of modern Eve, acquisitive and desiring a partner-in-crime; *Conchita* is seen as evolving from the myth that presents Lilith as sadistic and masochistic.

The hero who seems heroic but proves an easy prey for the fatal woman often resembles the author who creates him. This is frequently evident in the writings of exotists, where the fatal woman is depicted as a goddess to be worshipped for the perfection of her evil. Women of this

nature created by such writers as Flaubert and Mallarmé are already decadent figures; and the depiction of the fatal woman as a bored queen of a decaying society in antiquity exerted a considerable influence upon her portrayal in the late nineteenth century.

It is suggested that the fatal woman is disguised as a female-dandy in decadent literature. Like her predecessors, she outdoes the male in her role. She is more perverse and more imaginative in crime than he, and it is she who reveals unnatural acts that are repulsive even to the

cynical decadent. Remy de Gourmont, Catulle Mendès, Joséphin Péladan and Octave Mirbeau represent their fatal women as perverse monsters. These women are less credible than their forebears because they are weighted down with the eccentricities and perversions of a specific period. This deliberate presentation of the fatal woman as the symbol for the evils of a moment seems to be a major cause for her literary demise.

Microfilm \$3.20; Xerox \$11.05. 245 pages.

LIBRARY SCIENCE

THE ATTITUDES AND OPINIONS
OF FARM FAMILIES IN ILLINOIS TOWARD
MATTERS RELATED TO
RURAL LIBRARY DEVELOPMENT

(L. C. Card No. Mic 61-92)

Mary Lee Bundy, Ph.D.
University of Illinois, 1960

The study was based on a four page questionnaire sent to 800 members of a panel of Illinois farm families in February, 1960. Members were asked concerning their reading habits, interest in having library materials and various library services made available to them. They were also asked their opinion as to the best way to obtain library service, their interest in receiving state assistance, and their general attitude toward library improvement in their community. Interest in library improvement was related to the socio-economic characteristics of the sample and to family interest in having library materials and services.

Major findings of the study include: farm families are generally unaware of the need for improved library service; they have not come to accept the public library as a tax supported institution. Interest in a number of library materials and services was shown. Families would most like materials dealing with vocational matters, home and family living, religion, and story books for their children. They have little interest in cultural materials. They are most interested in services to the groups to which they belong, film service ranking highest of all services suggested to them. They are also interested in having lists of books on subjects of interest brought to their attention through their farm magazines and newspapers.

Active support is more likely to come from heavy library users who are also heavy users of other media as well. Those with eighth grade or less education are less likely to be interested in library improvement. College graduates and those in lower income levels are not likely to oppose tax support for libraries although college graduates may adopt the position that their present service is adequate. Up to ten miles distance may not be a factor influencing use of libraries in a rural area.

The study concludes by discussing library service as it is perceived by the farmer, points out aspects favorable to rural library development and concludes by making general

recommendations for approaches to be used in projects and promotions designed to win farm acceptance for rural library service. Among the suggestions: Rural library service must be based on the needs and interests of its public, fitting into the work and social life of farm people and integrated with the other communications and educational agencies which serve the farmer. Use of book-mobiles in rural areas needs re-examination; service to school children may be losing its voting power. Heavy use of a demonstration service cannot be used as a measure of the strength of popular support.

Microfilm \$3.60; Xerox \$12.60. 277 pages.

A SYSTEM OF DATA BANKING
AND RETRIEVAL FOR EDUCATIONAL RESEARCH

(L. C. Card No. Mic 60-6612)

Donald David Denum, Ph.D.
The University of Texas, 1960

Supervisor: Dr. Benjamin Fruchter

Professional educators are being confronted more and more with the problems growing out of the recent changes in the bibliographic situation. The dynamic nature of the fields of knowledge, the imperative need for the quick exploitation of new developments in basic knowledge, and the extensive increase in periodical literature all have created difficulties in the identification and utilization of the graphic records of knowledge. Attempts to surmount these difficulties and to order and classify the records of knowledge so as to facilitate their efficient use are being made in various types of data storage and retrieval systems.

The purpose of this study is to plan and develop a system of data banking and retrieval for educational research--a system to serve a clientele of those individuals who teach, develop plans, and make decisions in the field of education.

An examination of the literature relative to man's attempts to order his knowledge reveals that from early times until as recently as early in the twentieth century these efforts were based on the assumption that there is

a "real," a "true" order in knowledge, if only man could discover it. It was quite late in the development of classification that man recognized the possibility of many systems of ordering--systems designed to meet his needs or suit his convenience rather than conform to any existing "correct" order.

Since this basic change in the philosophy of classification came about, two concepts of classification generally have been held: (1) the traditional concept of the bibliography of masses of knowledge encompassed by subject headings, and (2) the concept of the bibliography of ideas. Within the framework of the latter concept two types of systems for data storage and retrieval have been developed, based on the point in the storage and retrieval cycle at which search categories are formed. The first type provides for storing characteristics of documents according to a pre-arranged, fixed system at the time of storage. The second type provides for combining keywords as symbols of the characteristics of the document at the time of retrieval. The first type suffers from an inherent weakness; it is forced to take recourse in increasing complexity in order to satisfy the multi-dimensional and expanding areas of knowledge. The second type, based on the principle of coordinate indexing, combines flexibility of category manipulation with simplicity of classification but contains some serious weaknesses of its own.

This paper describes a modified system designed to minimize the serious weaknesses and to develop the full potential of the coordinate indexing system.

The rationale of the modified system provides a means whereby the ideas contained in a source document are represented by a complex of keywords or idea terms designated as descriptors--generic and dimensional. It is this complex of idea terms that constitutes the reservoir of communication units from which the staff members must draw in order to represent the ideas to be extracted from the language structure in a document. This means that the proposed system of data banking and retrieval operates on a probability basis, i.e., in order for the system to operate, the probability must be relatively high that the idea term selected from the reservoir by one staff member to represent an idea in a document is the same term as would be selected by another member indexing the same idea or one similar in nature. In the search routine, the analyst "bets" that the term selected on which to base a search is the same term as is used in storing the information.

This study describes the proposed system in detail. Its rationale is set forth, as well as a description of the techniques of operation using both a large scale random access memory, the IBM Ramac 305, and a simple searching machine, the sorter.

The writer envisions a system of this type becoming the focal point around which an information exchange can be established for educational research. Communication of knowledge must be effected, and the concept of librarianship must be expanded to include not only storage of the records of knowledge but also techniques for making possible their efficient utilization.

Microfilm \$2.75; Xerox \$8.00. 172 pages.

THE RELATIONSHIP BETWEEN THE PROFESSIONAL PREPARATION AND SUBSEQUENT TYPES OF LIBRARY POSITIONS HELD BY A SELECTED GROUP OF LIBRARY SCHOOL GRADUATES

(L. C. Card No. Mic 60-6064)

Ruth H. Rockwood, Ed.D.
Indiana University, 1960

Chairman: Dr. Raymond Gibson

This study is an inquiry into the relationship between the pre-professional education of the Florida State University Library School's master's degree graduates, their choice of electives in the basic year of professional education, and the subsequent positions held by these same graduates following completion of their training.

Procedure

The data for the study were derived from three sources. The official bulletins of the School and of the University provided information on the Library School's prescribed core curriculum, various programs, and elective courses. The second source of data was represented by the School's records of each graduate's undergraduate major and choice of electives in the graduate year of professional study. The third source was a questionnaire which provided information on employment, post-library school graduate education, professional activities and publications, and opinions of the graduates concerning their professional education. Data concerning the school were arranged chronologically, while data concerning the graduates were arranged in six categories related to the problem under study. For each category the number of men, of women and of both sexes, as well as the per cent of the total number of men, of women, and of both sexes were determined.

Findings

It was found that The Florida State University Library School has followed the specialist rather than the generalist approach to library education and that changes in the curricula have tended to strengthen this approach.

It was also found that the majority of the 251 graduates who responded to the questionnaire had majored, as undergraduates, in English, Education, Library Science or History. These same respondents had specialized, as graduates, primarily in college library service and in reference. For the most part, these graduates displayed a professional attitude toward librarianship as they published books and articles in the field, participated in professional organizations, undertook additional graduate work beyond the master's degree, and remained alert to the possibilities in their profession by recognizing the need for further study. Most of these graduates entered the college library field, a choice of position which followed closely their pre-service choice of electives in type of library. A close relationship was also discovered between choice of electives in area of specialization and subsequent positions held, but little if any relationship was discernible between undergraduate majors and the subsequent positions held. In evaluating their pre-service education, these graduates indicated that they favored more rather than less specialization.

Conclusions

The major conclusion from these findings was that the relationship between choice of electives and subsequent positions held was sufficiently close to warrant the continuance of the specialist rather than the generalist approach to library education.

Recommendations

Subject to the limitations of this study, the findings appear to justify the following recommendations: (1) that

motivation of graduates in choosing electives be studied; (2) that the relationship between choice of electives and success as a librarian be studied; (3) that the specialist rather than the generalist approach to library education be continued; (4) that an anonymous questionnaire study be undertaken to check validity of this study; and (5) that library schools experiment with offering greater specialization on a two-year sequence.

Microfilm \$2.75; Xerox \$8.00. 174 pages.

MATHEMATICS

FRACTIONAL FACTORIAL PLANS

(L. C. Card No. Mic 61-433)

Sidney Addelman, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Oscar Kempthorne

This study was concerned with plans for factorial experiments which would permit the estimation of the maximum number of effects and interactions with a minimum number of observations. To this end, methods were developed for constructing experimental plans which yielded (i) uncorrelated estimates of the desired effects and/or interactions and (ii) correlated estimates of the desired effects and interactions.

Several methods of constructing main-effect plans for $(s^n-1)/(s-1)$ factors, each at $s = p^m$ levels, with s^n treatment combinations were reviewed. As main-effect plans are identical to orthogonal arrays of strength two, the methods for constructing main-effect plans also apply to these arrays. A construction procedure was developed by which main-effect plans for $(s^n-1)/(s-1)$ factors are augmented to give main-effect plans for $[2(s^n-1)/(s-1) - 1]$ factors, each at s levels, with $2s^n$ treatment combinations. It was then demonstrated how orthogonal arrays of strength three and four could be derived from main-effect plans.

The principle of proportional frequencies, applied to the levels of each factor, was utilized to construct two classes of main-effect plans for asymmetrical factorial experiments, and a class of main-effect plans for symmetrical factorial experiments.

Finally some properties of irregular fractions of factorial experiments were investigated and a method for constructing plans for this type of experiment suggested. It was noted that the most useful irregular fractions were the $3/2^r$ replicates of 2^n experiments. Many of these plans permitted estimates of all main effects and two-factor interactions with fewer observations than would be required by orthogonal plans.

Microfilm \$2.75; Xerox \$5.00. 99 pages.

APPLICATIONS OF SEMI-MARKOV PROCESSES TO COUNTER AND RELIABILITY PROBLEMS

(L. C. Card No. Mic 60-6717)

Richard Eugene Barlow, Ph.D.

Stanford University, 1960

The classical Type I and Type II counters are censoring mechanisms which operate as follows. Particles or pulses arrive at the counter in some known fashion. For the Type I counter, the particle is registered (counted) and produces a dead time in the counter only if the counter is free. For the Type II counter, every particle generates a dead time. However, a particle is registered only if the counter is free at the moment of particle arrival. In the usual formulation of the counter problem, the input process is a renewal process. A natural generalization of this situation is to suppose that the input process is a semi-Markov process.

The main problem is to obtain formulas for the mean number of registrations, the probability that the counter is free at a specified time, and the distribution of time between successive registrations. This thesis obtains formulas for these quantities for a semi-Markov input process and a generally distributed dead time. Applications to signal detection problems are presented. An example treating the case of a missile salvo attack in the presence of an electronic warning system is presented in detail.

In order to solve generalized counter problems, some important properties of finite semi-Markov processes are developed. The first and second moments of the first passage distributions are calculated in terms of the stationary probabilities of the underlying Markov chain when this chain is ergodic. An asymptotic formula for the generalized renewal quantity is also obtained. Polya type theory proves useful in determining the error made in using a certain approximation for the mean occupation time in a particular state over a finite time interval.

In the last section of this thesis a unified treatment is made of a large class of so-called "repairman problems" which arise in reliability theory. The general model considered consists of m identical machines independent of one another and supported by n spare machines. Failed

machines are repaired by a repair facility consisting of s repairmen. The following questions are answered.

- (i) What is the probability that k machines will be operational at time t ?
- (ii) What is the distribution of time until a total failure occurs?
- (iii) What is the expected number of total failures in $(0, t)$?

The exponential case is treated as a special birth and death process. Several telephone trunking and queueing models are identified as repairman problems.

Microfilm \$2.75; Xerox \$5.00. 99 pages.

PERTURBATION OF AN AUTONOMOUS DIFFERENTIAL EQUATION WITH A PARAMETER

(L. C. Card No. Mic 61-268)

Russell Gene Bilyeu, Ph.D.
University of Kansas, 1960

In recent years a number of results have been obtained concerning the existence of invariant tori for periodic perturbations of autonomous differential equations. The objects of study here are n -dimensional differential equations of the form

$$(1) \quad dx/dt = F(x) + G(x, t, \epsilon)$$

in which G is periodic with respect to t , such that for $\epsilon = 0$ the perturbation term G vanishes and the resulting autonomous equation has a periodic solution $x = p(t)$. One asks of such systems whether there exists for each small non-zero ϵ an invariant torus in (x, t) space near the cylinder $x = p(s)$. By an invariant torus is meant an invariant surface of which each section determined by a fixed t is a simple closed curve $x = E(s, t)$, such that these sections are periodic in t with the same period as G . This periodicity allows one to consider the surface as a torus, and to apply to the solutions of (1) on the surface the well-known theory of differential equations on a torus.

It has been shown that if the linear variational equation at $x = p(t)$ has $n-1$ characteristic exponents with non-zero real part, then (provided, of course, that certain smoothness conditions are met) such tori do exist. Specifically, there is a positive number δ , such that for each ϵ of magnitude less than δ there exists an invariant torus $x = E(s, t, \epsilon)$ of (1), and the tori converge to $x = p(s)$ as ϵ approaches zero.

In Chapter I of the present study, the theory of invariant tori is extended to one-parameter families of equations of the type (1). If one considers a system

$$(2) \quad dx/dt = F(x, \mu) + G(x, t, \mu, \epsilon)$$

with a real parameter μ , which for each μ satisfies the hypotheses of the preceding paragraph, some obvious questions arise: (A) Can the positive number δ be selected so that for ϵ numerically less than δ there exists an invariant torus $x = E(s, t, \mu, \epsilon)$ for each of a "large" range of values of μ ? (B) Is the invariant torus continuous with respect to μ ? (C) For a specific perturbation (fixed value of ϵ), what can be said concerning the existence of

subharmonic solutions on the tori, or, in other words, what are the properties of the set of values of μ for which the rotation number is rational?

Question (A) and (B) are answered in the affirmative when μ is restricted to compact intervals. It is then established that the rotation number of the solutions of (2) on the invariant tori is a continuous function of the parameters. This provides a partial answer to question (C); namely, excluding any intervals on which ρ has a constant irrational value, the set of subharmonic solutions is dense.

In Chapter II, the equation of van der Pol with a periodic perturbation is used to illustrate the applications of the theory of Chapter I. Of particular interest is the fact that monotonicity of the period of the solutions of the autonomous system can be carried over to the rotation number for the perturbed system and, moreover, can be used to preclude constant irrational values of the rotation number. Thus, under certain conditions the answer to (C) is that the rotation number is rational on a dense set.

Microfilm \$2.75; Xerox \$3.00. 32 pages.

CONCERNING POLYNOMIAL SEQUENCES AND THE DISTRIBUTION OF THEIR ZEROS

(L. C. Card No. Mic 60-6607)

James Donnell Buckholtz, Ph.D.
The University of Texas, 1960

Supervisor: H. S. Wall

A sequence of polynomials $\{P_n(z)\}_{n=1}^{\infty}$ will be called an E_k sequence provided k is a positive integer and $\{P_n(z)\}_{n=1}^{\infty}$ satisfies the following conditions:

$$(i) \quad P_n(0) = 1, \quad n = 1, 2, 3, \dots$$

$$(ii) \quad \lim_{n \rightarrow \infty} \sum_{p=1}^{m_n} |a_{np}|^{k+1} = 0, \quad \text{where the numbers } a_{np} \text{ are defined by } P_n(z) = \prod_{p=1}^{m_n} (1 + a_{np}z), \quad n = 1, 2, 3, \dots$$

If $\{P_n(z)\}_{n=1}^{\infty}$ is an E_k sequence and M is the set of numbers z for which $\lim_{n \rightarrow \infty} P_n(z)$ exists and is not zero,

then $\{P_n(z)\}_{n=1}^{\infty}$ converges uniformly in every bounded region provided M is not mapped into a subset of the real numbers by a nonconstant polynomial transformation of degree k or less. In particular, the result follows provided M contains $(2k+1)$ points equidistant from the origin.

If $\{s_p\}_{p=1}^{\infty}$ is a sequence of complex numbers such that $s_p^{k+1} = o(p^k)$, then the sequence $P_n(z) = \prod_{p=1}^n \left(1 + \frac{zs_p}{n}\right)$

$n = 1, 2, 3, \dots$ is an E_k sequence. For sequences of this type, uniform convergence in every bounded region is implied by the weaker condition that M contain k points distinct from the origin. As a special case of the latter,

it follows that if $s_p^2 = o(p)$, then $\lim_{n \rightarrow \infty} \prod_{p=1}^n \left(1 + \frac{s_p}{n}\right) = e^s$

if and only if $\{s_p\}_{p=1}^{\infty}$ is $(C,1)$ summable to s .

In place of conditions on the set M , it is possible to express a simple equivalent condition on the numbers a_{np} .

If $u_q = \lim_{n \rightarrow \infty} \sum_{p=1}^{m_n} (a_{np})^q$ exists for $q = 1, 2, 3, \dots, k$, then the E_k sequence $P_n(z) = \prod_{p=1}^{m_n} (1 + a_{np}z)$, $n = 1, 2, 3, \dots$, converges uniformly in every bounded region to $e^{g(z)}$, where $g(z) = \sum_{q=1}^k \frac{(-1)^{q-1}}{q} u_q z^q$.

Microfilm \$2.75; Xerox \$3.00. 26 pages.

ON MEASURE AND INTEGRATION

(L. C. Card No. Mic 60-5905)

Richard Brian Darst, Ph.D.
Louisiana State University, 1960

Supervisor: Professor Pasquale Porcelli

The purpose of this dissertation is to present a Lebesgue-Radon-Nikodym type decomposition for bounded and finitely additive set functions (measures) on a set algebra (X, S) (i.e. S is a collection of subsets of a set X , containing X and closed under finite union and complementation) and to distinguish between the basic nature of S -type (Stieltjes) and L -type (Lebesgue) integration with respect to a finitely additive set function. A bounded and finitely additive set function f on S is a real valued function on S such that 1) $f(E + F) = f(E) + f(F)$ when each of E and F is in S and $E \cdot F = \emptyset$ and 2) $\text{lub}_{E \in S} |f(E)| < \infty$.

We denote the class of all such functions by $H(X, S)$ and, for each such function and each set E in S , we set $V^+(f, E) = \text{lub}_{F \in S, F \subseteq E} [f(F)]$, $V^-(f, E) = \text{glb}_{F \in S, F \subseteq E} [f(F)]$, and $V(f, E) = V^+(f, E) - V^-(f, E)$. The number $V(f, E)$ is called the variation of f on E and for $E = X$ defines a norm for $H(X, S)$ under which $H(X, S)$ is a NLC or Banach space.

The principal results of this paper are Theorem 2.2 where it is proved that if each of f and g is in $H(X, S)$, then there exist uniquely h and s in $H(X, S)$ such that 1) $f = h + s$, 2) h is absolutely continuous with respect to g (i.e. if $\epsilon > 0$, there exists a $\delta > 0$ such that if $E \in S$ and $V(g, E) < \delta$ then $V(h, E) < \epsilon$), and 3) s is singular with respect to g (i.e. if $\epsilon > 0$, there exists $E \in S$ such that $V(g, E) < \epsilon$ and $V(s, X - E) < \epsilon$), and Theorem 4.2 which asserts that the natural setting of the L -type integral is a sigma algebra. It is apparent that, for each g in $H(X, S)$, each of $H_c(g) = [f \in H(X, S); f \text{ is absolutely continuous with respect to } g \text{ on } S]$ and $H_s(g) = [f \in H(X, S); f \text{ is singular with respect to } g \text{ on } S]$ is a subspace of $H(X, S)$ and that $H_c(g) \cdot H_s(g) = 0$. Hence, from the point of view of linear space theory, the problem in Theorem 2.2 is to show that for each g , $H(X, S)$ is the direct sum of $H_c(g)$ and $H_s(g)$. Also, it will follow from our proof (cf. Corollary 2.2.1) that if (X, S) is a sigma algebra (i.e. S is closed under countable union) and g is completely additive on S (i.e. if $\{E_i\}$ is a sequence of pairwise disjoint elements of S , then $\sum g(E_i) = g(\sum E_i)$), then there exists a g -summable function y on X such that $h(E) = \int_E y dg$ for each $E \in S$.

Thus, an implicit result of this paper is that, in general, the Radon-Nikodym theorem can always be regarded as a special case of a Lebesgue decomposition.

The proof presented of Theorem 2.2 is self contained. In the third chapter of this paper, we outline an alternate proof using the theory of sequential weak convergence and compactness in the space $H(X, S)$. We feel that this is of interest because our application of this theory points out some important implications of the theory.

Microfilm \$2.75; Xerox \$3.00. 34 pages.

SOLUTIONS OF A SYSTEM OF TWO NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS OF THE FIRST ORDER, WITH ACCESSORY BOUNDARY CONDITIONS.

(L. C. Card No. Mic 60-6611)

Edmund Ike Deaton, Ph.D.
The University of Texas, 1960

Supervisor: Dr. H. J. Ettlinger

If $f^i(x^1, x^2, u^1, u^2)$, $i = 1, 2$, is continuous in all of its arguments for $0 \leq x^1 \leq a$, $0 \leq x^2 \leq b$, all u^1 and all u^2 , and if f^1 satisfies a Lipschitz condition in u^1 and u^2 , and if $g(x^2)$ is continuous for $0 \leq x^2 \leq b$ and $h(x^1)$ is continuous for $0 \leq x^1 \leq a$, then there is one and only one pair $u^i(x^1, x^2) = u^i(x)$, of functions continuous in x defined over $[0, a; 0, b]$ such that

$$u_1^1(x) = f^1(x^1, x^2, u^1(x), u^2(x))$$

$$u_2^2(x) = f^2(x^1, x^2, u^1(x), u^2(x)) ,$$

and

$$u^1(0, x^2) = g(x^2)$$

$$u^2(x^1, 0) = h(x^1) .$$

Under certain stated additional conditions this system is equivalent to one second-order nonlinear hyperbolic partial differential equation with accessory boundary conditions on a restricted region.

The existence of solutions to the pair of differential equations together with the boundary conditions is proved by two methods. One makes use of an analogue of the Cauchy-Euler polygon method and the other makes use of the method of successive approximations.

Microfilm \$2.75; Xerox \$3.00. 47 pages.

ON THE CONSEQUENCES OF
MOMENTUM CONSERVATION LAWS IN
A GRAVITATIONAL THEORY OF
THE WHITEHEAD TYPE*

(L. C. Card No. Mic 60-6613)

James Arthur Dyer, Ph.D.
The University of Texas, 1960

Supervisor: Dr. Alfred Schild

An action-at-a-distance gravitational theory of the Whitehead type has recently been proposed which is derived from a single action principle for a system of particles, and whose integrand is Lorentz invariant and symmetric in all the particles. It is shown in this paper that because of the Lorentz invariance of the action integral of this theory there exist identities which can be put into the form of linear and angular momentum conservation laws by use of the equations of motion. It is then shown that as a consequence of these laws there exists a relativistic center of mass which is in uniform motion, and there will be no secular acceleration of the Newtonian center of mass of an isolated system in contrast to the result predicted by the Whitehead theory.

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Microfilm \$2.75; Xerox \$3.60. 63 pages.

GENERALIZED DERIVATIVES

(L. C. Card No. Mic 61-277)

Edward D. Gaughan, Ph.D.
University of Kansas, 1960

The purpose of this thesis is to develop the theory of a certain type of generalized derivative. We consider a topological space X , a non-discrete Hausdorff topological field R and a set W of functions from X into R . If $x \in X$ and $f_1, \dots, f_n, g_1, \dots, g_n \in W$, we say that f_1, \dots, f_n are differentiable with respect to g_1, \dots, g_n at x if and

only if $\lim_{x_i \text{ tends to } x} \frac{\det\{f_j(x_i) - f_j(x)\}_{i,j=1}^n}{\det\{g_j(x_i) - g_j(x)\}_{i,j=1}^n}$ exists as x_i tends to x in a certain prescribed way for $i = 1, \dots, n$.

This derivative is written $\frac{\partial(f_1, \dots, f_n)}{\partial(g_1, \dots, g_n)}(x)$.

If $g_1, \dots, g_{i-1}, f, g_{i+1}, \dots, g_n$ are differentiable with respect to g_1, \dots, g_n at $x \in X$, we will say that f is

differentiable with respect to g_i at x . Also, $\frac{\partial f}{\partial g_i}(x)$ will

be written in place of $\frac{\partial(g_1, \dots, g_{i-1}, f, g_{i+1}, \dots, g_n)}{\partial(g_1, \dots, g_n)}(x)$.

If X has a uniform structure, the notion of uniform differentiability is also discussed.

Chapter I includes the basic definition of the generalized derivative and a few definitions and theorems concerning topological fields.

In Chapter II, some of the usual theorems from standard differentiation theory are proven for this generalized derivative under certain restrictions on the limit process involved. For example, under fairly general conditions the usual formulas for a change of variable and the differentiation of a product hold.

A function $f: X \rightarrow R$ is said to be of class G^1 on $\theta \subset X$ if and only if for each $x \in \theta$ there are $h^i(x) \in R$ for $i = 1, \dots, n$ such that for each $y \in X$,

$$f(y) - f(x) = \sum_{i=1}^n h^i(x)[g_i(y) - g_i(x)] + Q(x, y),$$

where for each neighborhood N of 0 in R , there is a neighborhood θ' of x such that if $y \in \theta'$, then

$$Q(x, y) \in \sum_{i=1}^n N[g_i(y) - g_i(x)].$$

In Chapter III, functions of class G^1 are discussed. Here we prove an analogue of the chain rule and under certain more restrictive conditions, analogues of the inverse function theorem, the implicit function theorem, and the functional dependence theorem are developed.

Microfilm \$2.75; Xerox \$3.00. 45 pages.

ON JACOBI METHODS AND
BLOCK-JACOBI METHODS FOR
COMPUTING MATRIX EIGENVALUES

(L. C. Card No. Mic 60-6734)

Eldon Robert Hansen, Ph.D.
Stanford University, 1960

This thesis considers several aspects of applying Jacobi methods for computing the eigenvalues of a Hermitian matrix or the principal values (singular values) of an arbitrary square matrix of complex elements. In general, Jacobi methods are concerned with transforming a matrix A to yield $D = UAV$, where U and V are unitary matrices of such a special nature that D is diagonal. In practice, a sequence of transformations of the form $A_{k+1} = U_k A_k V_k$ ($k = 0, 1, 2, \dots$) is performed with $A_0 = A$. If A is Hermitian, V_k is chosen to be U_k^* , the Hermitian conjugate of U_k .

In a block-Jacobi method, the matrices A_k , U_k and V_k are each partitioned into $\nu \times \nu$ square blocks, where ν divides the order n of A . The blocks are numbered by double indices in the same manner as if they were single elements. The matrices U_k and V_k differ from the identity matrix only in the four blocks with index pairs (i_k, i_k) , (i_k, j_k) , (j_k, i_k) and (j_k, j_k) for some sequence of index pairs $\pi_k = (i_k, j_k)$ ($k = 0, 1, 2, \dots$). The sequence $\{\pi_k\}$ and the elements of U_k and V_k are chosen according to some fixed rules. Given rules determining these quantities, the problem is to determine whether A_k becomes diagonal in the limit $k \rightarrow \infty$, and, if so, whether A_k approaches a fixed diagonal matrix in the limit.

Portions of the thesis consider ordinary Jacobi methods, for which $\nu = 1$. Cyclic Jacobi methods are

considered in which the index pairs $\pi_k = (i_k, j_k)$ ($i_k < j_k$) are chosen cyclically so that each index pair occurs once in each cycle. It is argued that the ordering in the sequence $\{\pi_k\}$ affects the rate of (assumed) convergence of cyclic methods. An a priori criterion is given for determining which of two given orderings can be expected to produce faster convergence. Experimental evidence is presented which apparently confirms this analysis, even though it indicates that the rates of convergence for different orderings differ only slightly.

It is proved that certain orderings are equivalent in that the matrix A_k after any fixed number of complete cycles is the same for each ordering. In particular, it is shown that the so-called ordering-by-rows and ordering-by-columns are equivalent. G. E. Forsythe and P. Henrici have proved that for these two orderings A_k converges to a fixed diagonal matrix as $k \rightarrow \infty$, provided certain conditions are satisfied. This thesis proved that the conditions of their proof are not sufficient to assure convergence for all cyclic orderings.

Quasicyclic Jacobi methods are also considered and are shown to converge under certain conditions.

Biased Jacobi methods are introduced in which each rotation is such that the larger of the two affected diagonal elements after each transformation occurs higher on the diagonal. The matrix A is partitioned in the form

$$A = \begin{bmatrix} A_1 & A_2 \\ A_3 & A_4 \end{bmatrix}$$

and rotations are performed only on the elements of A_2 . It is shown that these elements converge to zero. However, an example is presented showing that, despite biasing, the eigenvalues of A_1 are not necessarily larger than those of A_2 . Experimental evidence is presented which indicates that this method is quite inefficient.

The general problem of block-diagonalization of a Hermitian matrix by a unitary similarity transformation is considered. Certain similarities to Jacobi methods are described, as is the inherent difficulty of any non-iterative method.

Finally, most of the results in a paper by G. E. Forsythe and P. Henrici, *The cyclic Jacobi method for computing the principal values of a complex matrix*, Trans. Amer. Math. Soc., 94 (1960), are extended to block-Jacobi methods. Microfilm \$2.75; Xerox \$6.20. 129 pages.

THE USE OF COMPLEX VARIABLES FOR SOLVING CERTAIN ELASTICITY PROBLEMS INVOLVING INTERSECTING BOUNDARIES

(L. C. Card No. Mic 60-6669)

Paul Henry Hutcheson, Ph.D.
The University of Florida, 1960

This paper develops a method of applying complex variables to intersecting boundary problems of a type such that one boundary may be mapped on the x-axis while the other is simultaneously mapped on the part of the unit circle with positive ordinate.

The usual complex variables attack is employed on the problem of a semi-circular notch in a semi-infinite sheet

under uniform tension, previously solved with real variables. The difficulties encountered are discussed and a method is developed to overcome these difficulties. The following expansions are developed to express the complex variable z in terms of powers of itself as long as it is confined to the part of the unit circle mentioned. On the unit circle $z = e^{i\theta}$ and the formulas are

$$e^{(2k)i\theta} = \frac{2i}{\pi} \sum_{m=-\infty}^{\infty} \frac{e^{(2m-1)i\theta}}{2k - (2m-1)},$$

$$e^{(2k-1)i\theta} = \frac{2i}{\pi} \sum_{m=-\infty}^{\infty} \frac{e^{(2m)i\theta}}{(2k-1) - 2m}, \quad 0 < \theta < \pi.$$

These formulas cause the imaginary part of the coefficient of each odd power to affect the real part of the coefficient of all even powers and similarly, the imaginary part of the coefficient of each even power to affect the real part of the coefficient of all odd powers. An expression for boundary conditions which cannot be solved by the usual method of equating coefficients of like powers for z , is divided into a part with real coefficients and a part with pure imaginary coefficients. To this latter part are applied the developed formulas, giving relationships for coefficients that are usually infinite series. From these may be taken a finite system of any size which may be solved giving solutions to any desired accuracy.

This method was applied to the semi-circular notch problem, giving results which are in agreement with the previous solution. The first thirty coefficients of a power series in z are listed.

The problem of a semi-elliptical notch in a semi-infinite sheet in uniform tension, previously unsolved, was solved by this method. A general infinite set of equations for coefficients are given which may be solved to any degree of accuracy for any ellipse. This solution is proved compatible with the circular notch solution.

The method here described promises to be useful because it allows the use of conformal mapping and also tends to produce equations readily handled by electronic computers. An IBM 650 computer was used on the circular notch problem and was satisfactory both in application and results.

Microfilm \$2.75; Xerox \$3.00. 57 pages.

ON CONJUGATE FUNCTIONALS

(L. C. Card No. Mic 61-253)

Wendell Lyons Jones, Ph.D.
Columbia University, 1960

It has been known for some time that there is a relation between conjugate convex functionals and certain numerical inequalities, including the Hölder, the Cauchy-Schwartz, the Schwartz, and the inequality between arithmetic and geometric means. It seems not so well known, however, that conjugate functionals enter into other diverse fields, e.g., game theory, volume, differential equations.

A theorem by W. Fenchel¹ occupies a central place in the subject. As a first step in achieving a broad appreciation of conjugate functionals, the paper takes as its main purpose an analysis of the Fenchel theorem via its extension to the general topological vector space. The paper

also generalizes to the same setting some work of E. R. Lorch² on the homogeneous case, and relates this to the Fenchel theorem.

The basic definition given by S. Mandelbrojt³ is followed for two real vector spaces, E and E' , in duality under the bilinear form: $(x, \xi) \rightarrow \xi x \in R$. For $G(x)$ any real functional with domain $T \subset E$ ($|T, G|$), T' is the set of all $\xi \in E'$ for which $\sup \{\xi y - G(y) : y \in T\} < \infty$; and for $\xi \in T'$, $G'(\xi)$ is this supremum. One has immediately: $\xi y \leq G(y) + G'(\xi)$ on $T \times T'$. $|T', G'|$ is the conjugate of $|T, G|$. For many purposes it is better to consider, not $|T, G|$, but rather $o|T, G|$, the set of points on and "above" $|T, G|$ in $E \times R$. The properties of $|T', G'|$ and $o|T', G'|$ parallel those of polar sets.

Topologies are necessary for a non-trivial theory. The multiplicity of possible topologies diffuses the theorem, and a short summary cannot be made. One palpable result is:

Let $\mathcal{F}(\mathcal{F}')$ be a topology on E (E') which is locally convex, Hausdorff, and compatible both with the vector structure of E (E') and with the duality.

Let T be a convex set in E with non-empty interior I , and let G be a real functional, convex and semi-continuous below on T , and continuous on I . Let also $\liminf \{G(z) : z \rightarrow x^0, z \in T\} = \infty$ for each point x^0 in the boundary of T with $x^0 \notin T$. Then there exists a unique functional $|T', G'|$ with domain in E' , having the same properties as $|T, G|$ (save that I' may be empty) such that $\xi y \leq G(y) + G'(\xi)$ for all $(y, \xi) \in T \times T'$, where to each $x \in I$ there corresponds at least one $\xi = \bar{\xi} \in T'$ such that the equality holds. In the same way, $|T, G|$ corresponds to $|T', G'|$.

The mapping $x \rightarrow \bar{x}$ ($x \rightarrow \text{grad } G(x)$) has significance in several contexts, as discussed in the paper. For $x \in T$, \bar{x} is an element of T' for which $\bar{x}y - a = \bar{x}x - G(x)$ is a support hyperplane to $o|T, G|$ at $(x, G(x))$ in $E \times R$. The use of $\eta x - G'(\eta) \leq G(x) = \bar{x}x - G(x)$ shows easily that if both $x \rightarrow \bar{x}$ and $\xi \rightarrow \bar{\xi}$ are well defined, they are inverse mappings.

The classical inequalities, worked out in some detail, derive from the homogeneous case: T a cone and G homogeneous of degree r . Here $|T', G'|$ is necessarily homogeneous of degree r' ($r^{-1} + (r')^{-1} = 1$), and throughout $T \times T'$, $\xi y \leq \phi(y)\phi'(\xi) \leq G(y) + G'(\xi)$, where $\phi(\phi')$ is the r^{th} (r'^{th}) root of $G(G')$.

The paper applies the theory to Banach spaces. Applications to zero-sum two person game theory, and to differential equations are indicated. Some suggestions for further research in the area of the Fenchel theorem are included.

1. Canad. Jour. of Math., vol. 1 - no. 1 (1949), p. 73.
 2. Trans. A.M.S., vol. 71 - no. 2 (1951), p. 243.
 3. C. R. Acad. Sci., Paris, vol. 209 (1939), p. 977.
- Microfilm \$2.75; Xerox \$4.40. 83 pages.

ON A CLASS OF NON-FLEXIBLE ALGEBRAS

(L. C. Card No. Mic 60-6961)

Frank James Kosier, Ph.D.
Michigan State University, 1960

Major Professor: Robert H. Oehmke

Let A be an algebra over a field F of characteristic not two such that:

I. The elements of A satisfy a non-trivial identity of the form

$$(1) \alpha_1(zx)y + \alpha_2(zy)x + \alpha_3y(zx) + \alpha_4x(zy) + \alpha_5(xz)y + \alpha_6(yz)x + \alpha_7y(xz) + \alpha_8x(yz) = 0 \text{ for fixed } \alpha_i \text{ in } F.$$

II. There is an algebra B over F such that B satisfies (1), B has an identity element, and B is non-flexible; that is, there are elements x and y in B such that $x(yx) \neq (xy)x$.

These conditions are similar to those used by A. A. Albert to define almost left alternative algebras [Almost alternative algebras, Portugal. Math. vol 8 (1949) pp. 23-36]. Albert's paper led to the study of algebras of (γ, δ) type by Kleinfeld and Kokoris.

Assume F to be algebraically closed. It is then shown that A is quasi-equivalent in F to an algebra $A(\mu)$ where $A(\mu)$ satisfies one of the following identities:

- (i) $R_{xy} - R_x R_y = -(L_{yx} - L_x L_y)$
- (ii) $R_x^2 + L_x^2 = 2L_x R_x$
- (iii) $R_x^2 + L_x^2 = L_x R_x + R_x L_x$
- (iv) $(R_x + L_x)(R_y + L_y) = (R_y + L_y)(R_x + L_x)$

If A is a power-associative ring satisfying (i), then A has a decomposition with respect to an idempotent e of A as $A = A_{11} + A_{10} + A_{01} + A_{00}$ where the A_{ij} are defined just as in the associative case. Any simple power-associative ring A , which satisfies (i) and has an idempotent e such that $A_{10} + A_{01} \neq 0$, is associative. Examples of simple power-associative non-flexible algebras satisfying (i) are constructed.

If A is a simple strictly power-associative algebra over a field F of characteristic prime to six satisfying (ii), A is either flexible or an algebra of degree one or two.

In the remaining two cases examples of simple non-flexible power-associative algebras which satisfy (iii) or (iv) are constructed.

Microfilm \$2.75; Xerox \$3.00. 55 pages.

HALF RINGS IN LINEAR SPACES

(L. C. Card No. Mic 61-425)

Peter Harrington Maserick, Ph.D.
University of Maryland, 1960

Supervisor: Professor R. E. Fullerton

In his book, Functional Operators, von Neumann introduces the idea of a half ring of sets and uses this concept

to define the measure over an n -dimensional linear topological space E^n . A collection \mathcal{R} of subsets of a set X is called a half ring if:

(i) $R, R' \in \mathcal{R}$ implies $R \cap R' \in \mathcal{R}$.

(ii) $R, R' \in \mathcal{R}$ and $R \subset R'$ implies the existence of a finite chain $\{R_i\}_{i=1,2,\dots,k}$ of members of \mathcal{R} such that $R = R_1 \subset R_2 \subset \dots \subset R_k = R'$ and $R_i \setminus R_{i-1} = \{x \in R_i : x \notin R_{i-1}\} \in \mathcal{R}$ for each $i = 2, 3, \dots, k$.

If X is a linear space and

$$R + z = \{x \in X : x = y + z \text{ for some } y \in R\} \in \mathcal{R}$$

for each $z \in X$ then \mathcal{R} is called a translation half ring. It has been shown [5] that certain classes of subsets in E^n whose closures are convex polyhedra form translation half rings and conversely that the only translation half rings of convex sets in E^n which generate the class of all Borel sets are such classes of sets. In this dissertation the above result is generalized by considering a translation half ring \mathcal{R} of convex sets which determines a weaker topology than the metric topology on a separable Banach space X . It is shown that the collection $cl(\mathcal{R})$ of topological closures of the members of \mathcal{R} is a collection of convex polyhedra. i.e. Each $cl(R) \in cl(\mathcal{R})$ can be expressed as the intersection of a finite number of closed half spaces.

The notion of a half ring is generalized and it is shown that if \mathcal{R} is such a collection of convex sets which is also an absorbing neighborhood base for a separable Banach space X with a real scalar field then $cl(\mathcal{R})$ is a collection of generalized convex polyhedra (polytopes). From this it follows that a separable Banach space X has such a neighborhood base if and only if the space is equivalent to a subspace of the space c_0 of all sequences which converge to zero. The space c_0 itself is characterized as the only Banach space which has a certain type of polytope (parallelotope) as its closed unit sphere.

The measure theoretic applications of these generalized half rings are also investigated. It is shown that a nonnegative measure function defined over such a class of sets has a unique extension to the σ -ring that this class generates. From this a collection $\{m_p^*\}$ (p a positive real number) of outer measures can be defined, over the Banach space l_∞ of all bounded sequences of real numbers, which have analogous properties to the collection $\{h_p^*\}_p$ of Hausdorff outer measures which can be defined over Euclidean n -space.

Microfilm \$2.75; Xerox \$3.60. 64 pages.

ORTHOGONAL POLYNOMIAL SOLUTIONS OF A CLASS OF FOURTH ORDER LINEAR DIFFERENTIAL EQUATIONS

(L. C. Card No. Mic 60-6676)

John Wesley Meux, Ph.D.
The University of Florida, 1960

Several well-known polynomials have arisen as solutions to a class of linear differential equations of the

second order. The polynomials of Jacobi, Hermite and Laguerre are classical examples that may originate in this manner. These polynomials become all the more interesting due to a number of properties which they have in common.

One of the more interesting of these properties is that of orthogonality, with respect to a weight function, of a set of polynomial solutions over a fundamental interval. The use of this property, in expanding an arbitrary function in a series of these polynomials, has proved to be a valuable contribution to the field of mathematics.

The problem of obtaining polynomial solutions, which possess these properties, of a class of fourth order linear differential equations is considered here.

The procedure followed is to develop conditions:

- (1) which assure the existence of polynomial solutions,
- (2) which are sufficient to determine orthogonality, with respect to a weight function, over a fundamental interval and
- (3) which enable arbitrary functions to be formally expanded in a series of these polynomials. These conditions are further developed for each of the three cases of the finite interval, the semi-infinite interval and the infinite interval.

Use of the derived conditions makes it possible to construct fourth order linear differential equations having polynomial solutions which are orthogonal, with respect to a weight function, over any desired interval.

Microfilm \$2.75; Xerox \$4.00. 73 pages.

STEADY STATE PROPERTIES OF SELECTED INVENTORY MODELS

(L. C. Card No. Mic 60-6747)

Richard Collom Singleton, Ph.D.
Stanford University, 1960

In this thesis, known techniques of analysis are applied to the investigation of a group of mathematical models related to the problem of inventory control. These models are felt to be of considerable practical interest, and have not been treated previously in the literature in the present generality.

A characteristic common to these models is the assumption that the quantity of resupply available for delivery to a stocking point in any one period is limited, in general random, and independent of demands served by the stocking point. It is assumed that a stocking point may accept all, part, or none of an available delivery, but does not have control over the availability of deliveries (except in the final model, where the basic random supply process is supplemented by delivery of emergency orders). Demands not fulfilled in a period are backlogged.

In the first model, a single stocking point is assumed to have random delivery quantities available to it, with random numbers of periods between availability of deliveries. These distributions, and the distribution of demand, are assumed to be mutually independent. The stocking policy considered is to accept an available delivery subject to a storage capacity limitation S when the stock is below s , where $s < S$, and otherwise to reject delivery. The limiting cases for $s = S$ and $S = \infty$ are also studied. This model is then extended to the case in which

the distribution of available delivery quantity depends on the number of periods since the last delivery.

The next model deals with a problem of controlling stock levels at n stocking points. It is assumed that a random delivery quantity is available each period, and is offered to the stocking points in the fixed priority order 1, 2, ..., n . Each stocking point is assumed to be independently following a stocking policy of the type described above. This model is then extended to the case in which the times between deliveries are random variables.

In the final model, a single stocking point has available each period a random delivery quantity. The full quantity available is accepted if the stock level is below S , and otherwise rejected. Then if the stock level is below an emergency level s , where $s \leq S$, an additional order is placed to bring the stock level up to S . Two versions of the rule for placing this emergency order are considered.

The steady state properties of the above models are studied, applying techniques which may be found in the work of Karlin. A basic pattern of analysis is repeated, with variations. First, considering the stock levels in successive periods as a sequence of random variables, a sub-sequence forming a Markov chain is identified; in this, methods used in a recent paper by Karlin and Fabens are followed. Next, the one-step transition relations for the Markov chain are determined, and from these a one-step transition operator T formulated as an integral equation. The stationary distribution F of stock level at delivery times, if it exists, is then a fixed point of T , i.e. $TF = F$. The problem of the existence of unique stationary distributions is not treated. However, in the examples worked it is possible in each case to reduce the integral equations to differential equations which can be solved.

The limiting distribution of stock level in an arbitrary period is then expressed as a transformation of the stationary distribution of stock level at delivery times. After assuming an appropriate cost structure, limiting one-period expected costs are evaluated. The optimum values of the decision parameters of the stocking policy are then determined by finding those values which minimize expected costs.

Microfilm \$2.75; Xerox \$6.60. 139 pages.

FACTORS CONTRIBUTING TO UNDERSTANDING OF SELECTED BASIC ARITHMETICAL PRINCIPLES AND GENERALIZATIONS

(L. C. Card No. Mic 60-6068)

Lewis William Stoneking, Ed.D.
Indiana University, 1960

Chairman: Dr. Hanne J. Hicks

Problem

The purpose of this investigation was to determine whether examinees' age, amount of teaching experience, level of academic preparation, or mathematics background contributed to their understanding of selected basic arithmetical principles and generalizations.

Procedure

This study was restricted to 1,066 examinees, including pupils in grades 8 and 12, students on a teacher preparatory program in grades 14, 15, and 16, and teachers in Indiana.

An objectively scored multiple-choice test was developed to determine examinees' understanding of selected principles and generalizations that were basic to arithmetic. A personal data sheet was designed for gathering pertinent data.

The final instrument used in these analysis was developed with the aid of educators in the fields of mathematics and education, examinees on a teacher preparatory program, results of a pilot study and subsequent item analysis, and opinions of 11 authorities in the area of arithmetic. The instrument's validity was determined by the combined opinion of a panel of experts, and no item was included in the final instrument unless at least 80 per cent of the authorities agreed the item was definitely valid for measuring understanding of some selected basic arithmetical principle or generalization. The instrument's reliability was found to be .92.

The collation of responses to the Test of Selected Basic Arithmetical Principles and Generalizations and information obtained from the personal data sheet provided the basis for statistically determining the selected factors that significantly contributed to examinees' understanding of the selected basic arithmetical principles and generalizations.

Conclusions

On the basis of the findings and within the limits of this study, the following general conclusions were drawn:

1. There seemed to be no consistency in the findings as to the significance of age as a factor contributing to examinees' understanding of selected basic arithmetical principles and generalizations.
2. Teaching experience did not seem to contribute significantly to examinees' understanding of selected basic arithmetical principles and generalizations.
3. Increased academic preparation generally seemed to contribute to examinees' understanding of selected basic arithmetical principles and generalizations.
4. Semesters of high school mathematics studied seemed to have a direct positive relationship with examinees' understanding of selected basic arithmetical principles and generalizations.

Implications

Relative to the conclusions of this study the following implications seem to be appropriate:

1. That more formal high school mathematics that is studied the more understanding of basic arithmetical principles and generalizations is acquired.
2. Some factor or factors in examinees' block of professional courses may have contributed to their understanding of basic arithmetical principles and generalizations.
3. Years away from formal undergraduate study seem to have a negative effect on understanding of selected basic arithmetical principles and generalizations.
4. Graduate work seemed to affect teachers'

understanding of selected basic arithmetical principles and generalizations positively.

Recommendations

The following recommendations are based on information gained by the investigator in his pursuance of the present study:

1. Existing mathematics courses required of prospective elementary teachers on the undergraduate level should be examined to ascertain their contribution to prospective elementary teachers' understanding of basic arithmetical principles and generalizations.

2. Prospective elementary teachers should be required to study four years of mathematics in high school.

3. Experienced elementary teachers should further their study of basic arithmetical principles and generalizations. Such a study may be facilitated by in-service workshops, by courses emphasizing basic arithmetical principles and generalizations, or by an individual's pursuit of understanding of principles and generalizations basic to arithmetic.

Microfilm \$2.75; Xerox \$8.20. 177 pages.

A HELLINGER INTEGRAL REPRESENTATION FOR BOUNDED LINEAR FUNCTIONALS

(L. C. Card No. Mic 60-6637)

James Ramsey Webb, Ph.D.
The University of Texas, 1960

Supervisor: Dr. Ralph E. Lane

Let $[a, b]$ denote an interval. Let $Q[a, b]$ denote the normed linear space of all complex-valued functions,

quasi-continuous on $[a, b]$; such that the norm of each function x in $Q[a, b]$ is $\text{lub}|x(t)|$ for all t in $[a, b]$.

Definition: " v has bounded slope variation with respect to u over $[a, b]$ " means that u is an increasing function on $[a, b]$, v is a complex-valued function on $[a, b]$, and there exists a nonnegative number B such that if $\{t_p\}_{p=0}^n$ is a subdivision of $[a, b]$ with $n > 1$, then

$$\sum_{p=1}^{n-1} \left| \frac{v(t_{p+1}) - v(t_p)}{u(t_{p+1}) - u(t_p)} - \frac{v(t_p) - v(t_{p-1})}{u(t_p) - u(t_{p-1})} \right| \leq B.$$

The least such number B is denoted by $V_a^b \frac{dv}{du}$.

It is shown that if v has bounded slope variation with respect to u over $[a, b]$, then (1) for each c in $[a, b]$ and d in $[a, b]$, each of

$$\lim_{t \rightarrow c-} \frac{v(t) - v(c)}{u(t) - u(c)} \quad \text{and} \quad \lim_{t \rightarrow d+} \frac{v(t) - v(d)}{u(t) - u(d)} \quad \text{exists}$$

(The first limit is denoted by $D_u^- v(c)$ and the second by $D_u^+ v(d)$), and (2) the Hellinger integral under refinement,

$$\int_a^b \frac{dx dv}{du} \quad \text{exists for each } x \text{ in } Q[a, b].$$

Theorem: Suppose F is a functional from $Q[a, b]$. F is a bounded linear functional which maps constants into zero if and only if there exist two functions u and v , with v having bounded slope variation with respect to u over $[a, b]$, such that

$$F(x) = \int_a^b \frac{dx dv}{du}$$

for each x in $Q[a, b]$ and

$$\|F\| = |D_u^+ v(a)| + V_a^b \frac{dv}{du} + |D_u^- v(b)|$$

Microfilm \$2.75; Xerox \$3.00. 27 pages.

MINERALOGY

EFFECT OF CLAY MINERALOGY ON CERAMIC PROPERTIES

(L. C. Card No. Mic 60-6287)

William Turner Elbert Jr., Ph.D.
Indiana University, 1960

Four clay raw materials were used to prepare thirty-seven ceramic mixes. Qualitative and quantitative clay mineral analyses of the raw materials were made by x-ray methods, and grain size distribution by mechanical and pipette analyses. Clay raw materials were combined with sand and silt to prepare test mixes with similar sand-, silt-, and clay-size fractions, but different kaolinite, illite, and mixed layer (illite-montmorillonite and illite-montmorillonite-chlorite) clay mineral content. Test forms were extruded from each mix, fired under identical conditions, and tested for a variety of ceramic properties.

Variations in ceramic properties are correlated with

variations in clay mineral proportions and other variable mix properties.

Mixes containing high proportions of kaolinite had high refractoriness, moisture expansion, water absorption, apparent specific gravity, and apparent porosity; intermediate drying shrinkage; and low firing shrinkage and fired strength. Glazed trials with high kaolinite content crazed after autoclave treatment.

Mixes containing high proportions of illite had high firing shrinkage, fired strength, and bulk density; intermediate moisture expansion, refractoriness, and apparent specific gravity; and low drying shrinkage, water absorption, and apparent porosity.

Mixes containing high proportions of mixed layer clay had high drying shrinkage; intermediate firing shrinkage, fired strength, water absorption, and apparent porosity; and low moisture expansion, refractoriness, apparent specific gravity, and bulk density. High mixed layer trials showed severe black coring, bloating, and glaze peeling.

Under the firing conditions used in this study (maximum temperature 1083°C.), high kaolinite trials were underfired and high mixed layer trials overfired.

Microfilm \$2.75; Xerox \$6.60. 136 pages.

GEOLOGY AND MINERALOGY OF
THE DELNO MINING DISTRICT AND VICINITY,
ELKO COUNTY, NEVADA.

(L. C. Card No. Mic 60-6234)

Donald Ray Olsen, Ph.D.
University of Utah, 1960

Chairman: Bronson S. Stringham

The Delno mining district is located in a Basin and Range type mountain composed of upper Paleozoic sediments in northeastern Elko County, Nevada. The district is bordered on the east by a zone of normal faults.

Within the district dips are generally to the west. The Paleozoic rocks are divided into three lithologic units. The oldest exposed sediments are correlated with the Manning Canyon formation and Tonka formation of Mississippian and Pennsylvanian age. An unconformity (?) separates the lowest from the middle sedimentary unit. The middle and upper units are correlated with the western

faceis of the Oquirrh formation in Gold Hill and the Moleen formation of eastern Nevada. A small granite pluton, thought to be of metamorphic origin is exposed in the district. In the Granite Creek area east of the Delno district rhyolite porphyry has intruded (?) the middle and upper sedimentary units. Faulting in the region has either been controlled by early Laramide shears formed by tangential forces set up by eastward movement of the area north of the Great Basin or by older Paleozoic or Precambrian structures formed by meridionally aligned forces. Uplifting of the range occurred during the Laramide orogeny, and major movement on the normal faults in the range immediately followed, coming before late Miocene. Movement on the faults has continued into the Recent epoch.

Tin is found in the district in close association with opal, chalcedony, and tridymite. The tin-bearing material is tentatively identified as a colloidal suspension of stannic oxide, which gives a rudimentary diffraction pattern of cassiterite. Physical, optical, and chemical properties of the tin mineral are quite distinctive. Quite possibly the mineral is a new variety, but this must be determined by further work. Lead occurs as cerussite, galena, bindheimite, massicot and anglesite. Silver is contained in the bindheimite and occurs as argentite with the galena. Mineralization is related to the intrusive rhyolite porphyry of early Tertiary age located east of the district, in the Granite Creek area.

Microfilm \$2.75; Xerox \$5.80. 120 pages.

MUSIC

MODAL THEORY OF
SIXTEENTH-CENTURY GERMAN THEORISTS

(L. C. Card No. Mic 60-6280)

Walter Thomas Atcherson, Ph.D.
Indiana University, 1960

Modal theories as set forth in thirty-two sixteenth-century German music treatises have been compared to and evaluated in terms of an arbitrary concept of mode. This arbitrary concept of mode has been defined as a series of pitches having certain fixed intervallic relationships, fixed range, and unique final.

A concept of mode as a series of pitches having fixed intervallic relationships was advanced in only eleven of the thirty-two treatises. Mode in these treatises was said "to arise from" or "to be contained in" the species of octave. Glarean's *Dodecachordon* of 1547 is the most well known and perhaps the most important of these treatises. Glarean postulated fourteen modes arising by means of arithmetic and harmonic division from seven species of octave; two of the fourteen modes were considered illegitimate, however, owing to the impossibility of division at, respectively, the fourth and the fifth.

Fixed range or ambitus was mentioned in almost all the treatises, though there was no common agreement among them as to what that range should be. Range of the ninth

for the authentic modes was advanced by many theorists, but so were ranges of the sixth, seventh, octave, tenth, and eleventh. Many theorists even contradicted themselves in attempting to fix the range of the modes.

The subject of a unique final also appears in the treatises, but, as with fixed range, there is again disagreement and contradiction. Some theorists maintain that there should be an alternate set of finals a fourth above the "regular" finals. Others maintain that there should be a set a fifth above the "regular" finals. Some suggest that the final should be used as a means of mode-recognition in musical analysis; others specifically condemn reliance on the final.

From this disagreement and confusion it can be concluded that sixteenth-century German theorists were having difficulty making modal theory appropriate to sixteenth-century music praxis; many of the theorists admit having this difficulty. It is possible to discern, though, the first faint hint of a theory of key. A "key" may be defined as a musical phenomenon which becomes known to the listener through the predominance of a single pitch, a pitch which is given predominance by, for example, its acoustical relationships to other pitches. Eucharius Hoffmann, in his *Doctrina de tonis seu modis musicis* of 1582, suggested that a mode can be identified by the root (using modern terminology) of the final triad; thus a mode (really key) can be discerned from a single pitch which has

become predominant owing to its acoustical relationships to the other members of the triad.

Microfilm \$2.75; Xerox \$8.80. 192 pages.

THE CHORAL MUSIC OF AARON COPLAND,
ROY HARRIS, AND RANDALL THOMPSON.

(L. C. Card No. Mic 60-5861)

Charles Edward Brookhart, Ph.D.
George Peabody College for Teachers, 1960

Major Professor: C. B. Hunt, Jr.

The purpose of this study was to make an analysis of the choral music of Aaron Copland, Roy Harris, and Randall Thompson in order to determine the style characteristics of this music, and to discover which of their compositions for the choral medium are most significant. The analytical procedures used were traditional ones except with regard to the element of harmony. The harmonic analysis of this music was based on a somewhat novel method formulated by the writer, and explained in detail in the first chapter of the dissertation.

Some Important Findings of the Study

The most significant choral compositions by Aaron Copland are: "Lark" (1938) and *In the Beginning* (1947). Of these, the latter is more significant, and is the largest of all his choral works. Perhaps the most important single feature of Copland's choral style is his preoccupation with the interval of a third. This manifests itself in a variety of ways. First, his melodies show a preference for disjunct motion. Ascending and descending intervals of thirds predominate. A descending interval of a third with a pause on the lower note is most characteristic. Second, his harmonic vocabulary consists primarily of tertian sonorities, although it is by no means limited to these. Contrapuntal passages are relatively more dissonant than homophonic passages. Third, the progression of chord roots is predominantly by thirds, and changes of tonal center are usually to a tonality which lies a third away. Economical use of thematic material is characteristic. The treatment of text is almost entirely syllabic. Literal word painting is rare. Natural speech rhythms are sometimes sacrificed for the sake of the musical idea.

Some of the most significant choral compositions by Roy Harris are: *Symphony for Voices* (1935), *Folk Song Symphony* (1939), *Mass for Men's Voices* (1948), and *Folk Fantasy for Festivals* (1956). Two dominant influences may be noted in his secular works--folk tunes and legends, and the poetry of Walt Whitman. Protestant hymn-tunes, Southern mountain ballads, Western cowboy songs, and Negro spirituals are some of the sources of folk influence. Harris's melodic and harmonic style is also closely linked to his own system of tonal semantics which classifies the modes and various sonorities on a graduated scale from the "brightest" to the "darkest." His harmonic vocabulary is limited to major and minor triads, their inversions, and polychords of one triad superimposed upon another. Counterpoint in his music is the movement of melodic lines through a harmonic texture. Consequently, the dis-

sonance level of contrapuntal passages is not significantly higher than in homophonic passages. The treatment of texts is both syllabic and melismatic. Literal word painting is common.

Some of Randall Thompson's most significant choral works are: *Americana* (1932), *The Peaceable Kingdom* (1936), *The Testament of Freedom* (1943), and *Requiem* (1958). Perhaps the most outstanding feature of his choral music is the craftsmanship which it exhibits. Melodic lines are interesting and relatively easy to sing. Great care is taken to choose appropriate rhythms and textures for projecting both the sounds and the meaning of the texts. The variety of word painting devices, both literal and subjective, is almost unlimited. Every nuance, every detail is carefully marked, leaving little to the imagination of the individual choral director. Thompson's harmonic idiom is conservative, in many respects quite traditional. Melodic contours and contrapuntal devices used show a significant influence of the Renaissance and Baroque periods. Sequential development techniques are very characteristic.

Microfilm \$3.85; Xerox \$13.50. 297 pages.

A STUDY OF THE LIFE AND WORKS OF
LUTHER WHITING MASON

(L. C. Card No. Mic 60-3309)

Kenneth Hartley, Ed.D.
The Florida State University, 1960

Luther Whiting Mason (1818-1896) was a Maine-born educator who achieved international acclaim in the field of public school music. Although he attained distinction as a teacher in the key cities of Louisville, Cincinnati and Boston, his greatest recognition came from editing the *National Music Course*, most widely distributed school music series of the nineteenth century. This set of books, based on his methodology, was the first series designed to lead sequentially through a course of music study. *National Music Course* was entered in the educational exhibits of international expositions at Philadelphia, Paris and Vienna, and consistently won highest honors.

Success of the *National Music Course* motivated the Japanese Ministry of Education to introduce vocal music in the public schools of the empire with Mason as director. Because of his subsequent success in the Japanese schools, Mason was given the rare opportunity of teaching in the royal court. The present day custom of requiring court musicians to play a traditional western instrument in addition to an indigenous instrument began with Mason's instruction in the imperial household.

After his return from Japan, Mason made a visit to Germany to gather material for future publications and to obtain constructive criticism of his books from prominent teachers. The Leipzig Music Teachers' Association praised the *National Music Course* and Karl Reinecke stated that it was better than any existing systems then in use in Germany. The ultimate result of this visit was the publication by Breitkopf and Hartel of *Neue Gesangsschule*, a German counterpart of the successful American series, compiled under Mason's supervision. An edition of *Neue Gesangsschule* was later published for use in the schools of Switzerland.

Additional accomplishments of Mason's which receive considerable attention in this study include: (1) establishment of the first successful system of music supervision utilizing classroom teachers, and (2) instrumentality in the organization of the original music division of the National Education Association.

Although such achievements as these would seem to place Mason on an equal basis with other leaders in nineteenth century public school music, he has consistently received less recognition for his work. Chase, Howard, and Ritter, in the most complete studies on the history of American music, fail to mention the name of Luther Whiting Mason, and Birge, most extensive published study of the history of music education in America, devoted less than fifteen pages to an account of his activities. Among the relatively few sources containing facts of Mason's life there are disagreements which extend even to the place and date of his birth.

Since no full scale investigation of Luther Whiting Mason has been made previous to this time, this study is intended as a definitive examination of his life and works. Chapter one presents his biographical data in its correct chronological order of occurrence. A consideration of Mason's work as an editor, descriptions of the content of his books and an examination of the impact of these publications on public school music in the nineteenth and twentieth centuries are included in chapter two. Chapter three contains a full description of Mason's methodology with particular reference to the influence of his predecessors Lowell Mason and Christian Heinrich Hohman. The final chapter is devoted to Mason's unique influence on primary school music, music supervision, music in the rural schools, and the music education profession.

Microfilm \$2.75; Xerox \$6.40. 134 pages.

JOHANN NEPOMUK DAVID'S CHORALWERK:
A STUDY IN THE EVOLUTION OF A
CONTEMPORARY LITURGICAL ORGAN STYLE.

(L. C. Card No. Mic 60-6554)

Donald Charles Johns, Ph.D.
Northwestern University, 1960

The subject of the study is the Choralwerk--twelve books of organ chorales composed over the years 1930-1952--by the contemporary Austrian composer, Johann Nepomuk David. Although an Austrian, David has lived the greater part of his life in Germany, and was influenced by the so-called Orgelbewegung, or organ reform movement, which began in that country in the 1920's, and provided the impetus that gave rise to a new school of German composers who have subsequently concerned themselves with the creation of new music for the German Protestant Church. By virtue of the Choralwerk alone, David stands in the forefront of the composers of church music presently active in Germany.

In the study, the development of the composer's style is traced from its traditional beginnings in the earlier works, to the contemporary style of the later settings. Of special concern in the analysis is the problem presented in connection with the use of pre-existent melodic materials which must be integrated into the fabric of a

twentieth-century style, the basic tonal orientation of which is considerably more complex and free.

The early works of the collection are characterized by a chord-based counterpoint that suggests, with but few alterations, the style of J. S. Bach. After these early works, functional harmonic aspects begin to disappear, and the sense of the harmonic flow must be sought in the unique combination of contrapuntal lines. At this point, the composer also exhibits a greater interest in strong-beat dissonance and less concern with its resolution. The V-I cadence is gradually abandoned, and experiments with different types of cadences tend to reflect the emancipation of the harmonic aspect of the works.

One characteristic dissonance, the simultaneous cross relation, points up an important procedure of the composer, namely, polytonality. Polytonality emerges through the use of the real answer in connection with a predominance of imitative writing. Polytonal procedures are enhanced by the employment of polymeter, which comes about, in the first instance, by way of the cantus firmus technique involving the statement of a chorale melody in long notes, against which is placed an accompaniment in shorter note values; because the accompaniment in shorter notes is usually based on the cantus firmus, the effect is one of having a statement of the melody on two (or more) metric levels.

The polytonality and polymeter of the Choralwerk are intimately bound up with a favored structural approach of the composer in which the chorale melody is presented against itself in various combinations of the normal permutations such as augmentation, diminution, inversion, etc. Such combination methods tend to exert an almost total control upon the harmonic character of the settings.

The composer succeeds in achieving a synthesis in which the chorale melody of the sixteenth and seventeenth centuries is successfully integrated into a twentieth-century style by the mere extension of traditional polyphonic processes. Through the use of the real answer in imitative situations emerges polytonality, and through the application of cantus firmus techniques comes polymeter. When these are employed as part of an over-all texture involving the combination of various thematic permutations, the result is a contemporary style, the complexity of which circumvents the symmetry of the underlying chorale melody, but which is, at the same time, compatible with its tonal nature.

Microfilm \$3.80; Xerox \$13.30. 295 pages.

A HISTORY AND SURVEY OF
COMMUNITY MUSIC IN MOBILE, ALABAMA.

(L. C. Card No. Mic 60-3312)

Robert Allen Kennedy, Ed.D.
The Florida State University, 1960

This study consists of a history of music in Mobile, Alabama, in conjunction with a study of the organized contemporary community music activities available to the adult white population of the Urbanized Area of that city.

The music history, which was considered essential to any adequate interpretation of existing conditions, was pursued in more detail than originally planned when it was

found that this topic had not been previously treated on any systematic basis. Materials used in this section were gathered primarily from private collections of clippings and programs, from newspaper files, and from interviews with Mobile citizens. The current status of community music was investigated by means of an instrument which was treated as a questionnaire for directors of church choirs within the scope of the study, and as an interview schedule for directors of other performing community music groups. In addition, interview schedules were constructed for music service and affiliated groups.

Instruments were designed to provide a measure of the degree to which the adult white population utilizes the musical services offered by music stores, conservatories, libraries, and other institutions. Areas of investigation with regard to performing organizations concerned the characteristics, membership, and leadership of such groups.

No standards, or statements of modal practices in the field of community music for communities of given sizes and circumstances, have been established. However, certain objectives and principles of operation have been established sufficiently well as to be published in professional journals. Within the framework of reference to these principles, to such comparative data as do exist, and to the historical background of the community's music, conclusions have been drawn.

In view of the handicaps under which community music has operated in Mobile, it may be deemed remarkable that certain groups have maintained artistic standards in keeping with a tradition for musical excellence which dates from the early nineteenth century. On the other hand, there is little evidence to suggest that music has been effectively used to promote increased understanding among social classes; indeed, music has perhaps served more as a symbol of distinction and differentiation than as a means of unification.

Local conditions detrimental to the optimum development of community music include the adherence to a tradition that music is a luxury of the elite, the support of extreme conservatism in government, and the practice of observing Mardi Gras with such prodigality that possible philanthropies to music and other arts are seriously curtailed. Among the effects of such conditions have been a reluctance on the part of city government to provide effective support for music in the schools or in the city, and a general failure on the part of existing organizations to synthesize artistic and social objectives.

Of critical importance among the factors which have impeded musical efforts in community has been the lack of continuing, stimulating leadership for the total cause of community music. A first step toward providing this leadership was made in recent years with the formation of the Mobile Arts Council. The fact that this group has employed as its director for the coming year a man of recognized qualifications improves the city's prospects for developing an effective community music program.

Microfilm \$4.95; Xerox \$17.35. 385 pages.

THE SEVILLE CANCIONERO: TRANSCRIPTION AND COMMENTARY.

(L. C. Card No. Mic 60-6163)

Robert Clement Lawes, Jr., Ph.D.
North Texas State College, 1960

The Seville Cancionero is a manuscript collection of songs from late fifteenth-century Spain, and it is preserved today in the Biblioteca Colombina of Seville with the number 7-1-28.

Establishing a date for this manuscript, or for its contents, is difficult because of a general lack of factual data concerning Spanish music and musicians. However, since many of the songs in this collection are also found in other manuscripts known to date from the late fifteenth century, it may be inferred that its contents represent the Spanish secular song of that period. Similarly, the fact that one of the songs alludes to the battle of Granada proves that the codex could not have been compiled before 1492. In addition, all of the known extant works of Triana are included in the Seville Cancionero; and since a Juan de Triana is known to have been a prebendary of the Cathedral of Seville during the latter part of the fifteenth century, it may be inferred that if the composer and the prebendary are the same man, this manuscript was probably compiled in Seville where he appears to have been active.

The notation in the codex is the white mensural notation common to all late fifteenth-century European music, and no problems were encountered in its transcription other than those caused by carelessness on the part of the scribes and by the many emendations apparently made by later hands.

A study of the contents of the Seville Cancionero shows three phases in the development of the Spanish musical style of the latter half of the fifteenth century. The first phase reflects a Spanish imitation of the contemporary Franco-Flemish style. The second phase appears to be a modification of that style in which the compositions show imitation, melismas, and short musical phrases to be employed in such a way that certain words or word-groups are emphasized by the music.

The third phase, however, shows a simplification in the construction of both the texts and the music. The texts of these songs are on the same subjects, love, religion, etc., as those in the more complex songs which reflect a dominant French influence, but the poetry is not polished. On the other hand, it expresses its subject in a more direct and forthright manner, and it is often humorous.

The music, too, is more direct. No longer is flowing counterpoint employed. Instead, the texts are set syllabically to music which has a homophonic texture, and the resulting songs are brief and folk-like in character. Whether these songs are polyphonic settings of popular songs of the time, or whether they are aristocratic imitations of popular music cannot be determined at this time.

Brief biographical sketches of all of the known poets and composers include all of the significant data concerning these men. Unfortunately, however, these data are generally fragmentary and the activities of a man, especially in the case of a musician, can rarely be traced for more than a few years.

Finally, the transcriptions are accompanied by a concordance, which includes the variants in the readings of

the musical texts given in other manuscripts; by as many complete texts as could be located, together with variants in the readings; and by editorial comments which serve to further identify or explain specific compositions.

Microfilm \$4.95; Xerox \$17.55. 388 pages.

THE MASSES AND HYMNS
OF COSTANZO PORTA.
[with] MUSICAL SUPPLEMENT.

(L. C. Card No. Mic 60-4857)

Lilian Pibernik Pruett, Ph.D.
The University of North Carolina, 1960

Supervisor: Glen Haydon

Porta's book of twelve Masses published in 1578, two Masses surviving in Codex 34 at the Archives of Loreto, and a book of hymns published posthumously in 1602 furnish the material for this study. The Masses are written for four to eight voices and represent the basic structural types in use during the sixteenth century: free Masses, cantus firmus Masses, and parody Masses. The free Masses are composed according to the first six modes, Dorian, Phrygian, and Lydian, and their respective hypomodes. Structural unity is achieved by the use of the same mode throughout a setting and is further enhanced by such devices as reuse of the same material at beginnings and endings of sections, and derivation of the melodic material for an entire Mass from an identifiable nucleus.

The cantus firmus Masses fall into two categories:

(1) those in which the same cantus firmus is used in all sections of the Mass (Missae La sol fa re mi and Da pacem), and (2) those in which different pre-existent melodies are used in the various sections (Missa de beata Virgine and two Missae mortuorum). The latter type raises a problem with regard to modality. The chants of the plainsong Mass cycles are not unified modally. While Porta retains the modal differences in the Missae mortuorum, he applies transposition to the chants used in the Missa de beata Virgine apparently in an attempt to maintain a unified modality throughout the Mass setting.

There are three parody Masses: Missa Audi filia based on a motet by Nicolas Gombert; Missa Descendit angelus based on a motet by Hilaire Penet; and Missa Quemadmodum the model of which remains unknown to date. The parody procedure encountered in the Missa Descendit angelus is remarkably free, consisting, for the most part, of incorporating portions from the individual voices rather than entire polyphonic sections of the model into the Mass.

The texture of the Masses varies in intensity, ranging from chordal to highly imitative. Brief sections of chordal writing are frequently found in the two longest sections of the Mass text, Gloria and Credo, while the Sanctus, Benedictus, and Agnus Dei movements are imitatively set, sometimes including canon in the final Agnus Dei.

Porta's Hymnodia sacra consists of forty-four hymns which are distributed as follows: sixteen for the Proper of the Season, eighteen for the Proper of Saints, eight for the Common of Saints, one for the Ordinary of the Office for Sunday, and one for the Dedication of a Church. Only

alternate strophes are set, either the odd-numbered, or the even-numbered strophes. The number of voices varies from three to six. The usual procedure followed by Porta is to reduce the number of voices in an inner strophe and increase the number of voices in the final strophe. This produces a climactic effect which is at times intensified by the use of canon in the final setting. The chant melodies are at times retained in unchanged form and presented in cantus firmus style, at other times they are freely paraphrased. The remaining voices may draw their material from the chants or they may be free. The settings of the individual strophes are comparable to the motet, that is, they are through-composed, if not through-imitated, and the entire hymn setting consists of several little motets. The hymn strophe has, most frequently, four lines of text, and the chant, correspondingly, four incises. The quadripartite form of the chant is frequently modified by repetition of incises, extensions by means of inserting free material between incises, and rhythmic contractions. Repeated sections of the chant are accompanied by new material in the remaining voices.

Microfilm \$5.65; Xerox \$20.05. 442 pages.

THE GUITAR WORKS OF FERNANDO SOR

(L. C. Card No. Mic 60-6995)

William Gray Sasser, Ph.D.
The University of North Carolina, 1960

Supervisor: Wilton Mason

Fernando Sor was born in Barcelona on or about February 13, 1778. His life, from a biographical as well as a compositional standpoint, can be divided into three distinct periods: the years in Spain (1778-1813), the years spent as a travelling virtuoso and composer in England, France, Germany, and Russia (1814-1827), and the years of his final retirement to Paris (1828-1839). During the first period Sor produced a number of works in various forms and for various mediums, almost all of which are now lost. The second period contained most of Sor's theater works and the early guitar works. The last period was devoted almost entirely to the composition of works for the guitar.

The total compositional output of Sor includes works in many categories--ballet, opera, vocal music, chamber music, and orchestral works. His compositions for the guitar are, however, the most important of all his works and among the most important ever written for the instrument. There are sixty-five opus numbers in this body of works, encompassing a total of more than three hundred compositions. The forms represented include variations, fantasies, études and other works of didactic nature, sonatas, transcriptions, and many short dance and genre pieces.

An examination of the guitar works has revealed that most of the shorter works are constructed in ternary and binary forms. The two "Grand Sonatas" are four-movement works. Sor's sonata-form movements contain a large amount of exposition material, and the developments are notably short. His melodic style is characterized by regularity of phrase structure and the triadic basis of

much of the melodic material. Both melodic and rhythmic ornamentation play a large role as variety factors, particularly in sections of a return to previously heard material. The choice of key is dictated in great part by the limitations of the guitar. Five major keys and one minor account for over eighty percent of the examples examined.

The texture of these works varies widely, both among and within works. The textural style is *freistimmig*, i.e. there is no strict adherence to a given number of voices. There is a more consistent adherence to a certain number of functioning parts. There are no examples of canon or fugue, but there are many examples of imitative texture.

Sor's harmonic procedures are firmly rooted in the common practices of his period. His harmonic language is essentially diatonic, although often colored with chromaticism. The frequent use of secondary dominants is an important factor in Sor's scheme of harmonic variety. All the common non-harmonic tones are found, as well as such altered chords as those of the diminished seventh, augmented fifth, Neapolitan, and augmented sixth. The works feature numerous devices which are idiomatic to the guitar, such as the *rasgueado*, *apagado*, and glides.

This examination of Sor's guitar works has not revealed a forgotten master. Sor's works are, indeed, frequently performed by the leading guitarists of our day. If Sor does not rank with the major figures in the total picture of music history, he must still be considered as the leading figure within his chosen branch of musical art.

Microfilm \$2.75; Xerox \$8.60. 188 pages.

A CHANSONNIER OF THE DUKES OF
LORRAINE: THE PARIS MANUSCRIPT
FONDS FRANÇAIS 1597.

(L. C. Card No. Mic 60-6166)

Clifford Marion Shipp, Ph.D.
North Texas State College, 1960

The manuscript *fonds français* 1597 of the Bibliothèque Nationale in Paris is one of the several large manuscript collections of vocal part music of the fifteenth and sixteenth centuries known as *chansonniers*. It is generally accepted that this manuscript dates from the early years of the sixteenth century. The manuscript contains seventy-eight folios of fine vellum. The folios show two separate sets of foliation. A Roman numeral is centered at the top of each folio recto, and an Arabic numeral appears at the top of each folio verso. Altogether Ms 1597 contains sixty-seven anonymous pieces in three and four parts: twenty-one *rondeaux*, seven *bergerettes*, three *ballades*, one *barzelletta*, one *lauda*, one *motet*, one *frottola*, five *song-motets*, twenty-four *chansons*, and three instrumental pieces. In the three-part works the voices are arranged with the *Superius* on the folio verso, the *Tenor* and *Contra* being on the adjacent folio recto. The four-part works follow a similar arrangement but with the *Tenor* appearing beneath the *Superius* on the folio verso, while *Altus* and *Bassus* appear on the folio recto opposite. Each voice part is decorated by a brightly colored border of varying dimensions in the left margin of both recto and verso folios. Neither the individual folios nor the entries in the table of

contents contains any references to the name of a composer. The entries in the table of contents are listed by means of short textual incipits, usually of two or three and sometimes four words. Paleographical differences in both music and text would seem to indicate that the manuscript is the work of at least two and possibly three scribes.

The arms on the final folio of the manuscript appear to be those carried first by René II de Vaudémont, Duke of Lorraine (1473-1508). Following René's death in 1508, the same arms were carried by his eldest son, Antoine, Duke of Lorraine (1508-1544). If it can be assumed that the appearance of the arms in Ms 1597 serves no purpose other than a sign of ownership, the manuscript must have belonged to one (or possibly both) of these two men. The general musical style of the pieces in Ms 1597 seems to point more to a period which corresponds roughly with René's reign.

The pieces in Ms 1597 are written in the white mensural notation which is found in most manuscripts dating from the last half of the fifteenth and first half of the sixteenth centuries. All of the individual note-shapes from the *Maxima* to the *Semifusa* are represented; ligatures of all varieties are also represented.

The sixty-seven compositions of Ms 1597 embrace a variety of musical styles which range from pieces dating as early as the 1450's to those which appeared about the turn of the fifteenth century. Forty-six pieces are in three parts, the remaining twenty-one being in four parts. The three-part works may generally be considered as comprising the older works of the collection. A number of pieces date from the late Burgundian School of Dufay and his contemporaries. A second group of pieces embrace a style which is characteristic of the beginning of the Franco-Netherlandish Period. The fully developed polyphonic style of the late fifteenth century is represented by a third group of pieces. Two of the three-part works and all but five of the four-part works fall into the formal category of the free chanson. Both the *chanson à refrain* and the *chanson* employing no refrain are represented. Certain pieces are based on a borrowed melody or *cantus prius factus*. The borrowed melodies in these pieces generally can be grouped into two categories. Either the melody is taken from a well-known folk song or monophonic art song, or a complete part (usually the *Tenor*) is borrowed from a pre-existent work. Both types of borrowed melodies appear in Ms 1597 in a variety of settings. The manuscript contains two examples of the *motet-chanson*. These pieces show a combination of a French secular text in the *Superius* and *Tenor* over a Latin sacred text in the *Contra*. Also included in the manuscript are a group of short pieces with sacred texts. These pieces, usually referred to as "song-motets," are distinguished by their simplicity, modest dimensions, and song-like character.

Microfilm \$7.40; Xerox \$26.35. 584 pages.

AN EVALUATION OF THE DEVELOPMENT
OF APPRECIATION FOR MUSIC
AS IT IS IMPLEMENTED BY
THE LIBERAL ARTS COLLEGE

(L. C. Card No. Mic 60-5405)

William Eugene Steward, Ed.D.
University of Oregon, 1960

Adviser: Robert E. Nye

Educational authorities have stated that the responsibility of higher education relative to fine art is to increase the understanding of the arts by the general student as well as by the specializing student. In reference to music a lack of agreement exists among musicians as to what music appreciation is, what is the best method of implementing its development, and how it may be measured.

The purposes of this study are: one, to attempt to discover whether or not a significant change on the part of the student in reference to appreciation of music occurs during college; two, to determine critical factors; three, to identify specific implications for teaching appreciation; and fourth, to develop a system whereby ability to appreciate music may conveniently and reliably be measured.

A random sample of freshmen and seniors in each of two universities and two liberal arts colleges in western Oregon was selected. The Herbert D. Wing Tests of Musical Ability and Appreciation was the instrument used to identify the level of music appreciation ability. A self rating scale was employed to obtain the musical background and interest. The description of the musical environment experienced during college was obtained through interviews with the administrative officials and faculty members.

The data were analyzed by using the Mann-Whitney method of testing the sum of ranks. The hypothesis tested is: the probability of the senior scores being greater or equal to the freshmen scores is less than or equal to one-half.

When music students were withheld from the sample, it was found that no significant increase on the part of the seniors over that of the freshmen relative to ability to appreciate music was observable. The students, both freshmen and seniors, who scored in the highest quartile possessed a rich musical background, as evidenced by the number of years of music lessons, ensemble participation and the extent of musical activity in the home.

Of those scoring in the lowest quartile, nearly sixty-five percent indicated no private lessons and not more than one year of ensemble participation or one course in music appreciation. A slightly higher percent indicated that their musical experience had been principally through radio and television.

CONCLUSIONS

Unless otherwise stated, the conclusions are presented from the findings when the music students have been withheld from the sample.

1. A student's appreciation for music is changed relatively little after reaching college.

2. The students of a given college do not vary significantly from the students of other colleges in ability to appreciate music.

3. Some individual participation in performance is essential for developing a high degree of appreciation for music.

4. The prevailing practice of requiring two to four credit hours in music appreciation courses is not sufficient to significantly increase a student's appreciation for music during college.

5. Experiencing music principally through radio and television is not sufficient to develop a high appreciation for music.

6. Seniors who have majored in music develop an appreciation for music that is significantly higher than that of college freshmen who plan to major in music.

7. Contrary to Wing's statement that training in music does not significantly bear upon ability to perform the tests, it was found that extensive training increased significantly the subject's ability to perform the test.

RECOMMENDATIONS

It is recommended that:

1. Since relatively little change in ability to appreciate music is observable after a student reaches college, emphasis should be placed upon participation in musical performance in the elementary and secondary schools.

2. The present music appreciation program in liberal arts colleges be adapted to include more individual participation in performance.

3. A system be put into practice in liberal arts colleges whereby the music appreciation ability of college freshmen and seniors may be reliably determined.

4. Experience in the use of a standard test for music appreciation be included in the music teacher education program.

5. The answer sheet for the Wing Tests of Musical Ability and Appreciation be redesigned to allow for more efficient scoring.

Microfilm \$2.75; Xerox \$9.25. 201 pages.

A HISTORY OF MUSIC IN RICHMOND, VIRGINIA FROM 1742 TO 1865.

(L. C. Card No. Mic 60-3316)

Albert L. Stoutamire, Ed.D.
The Florida State University, 1960

Standard literature depicting the history of Richmond, Virginia offers little information concerning music events and musicians of Richmond before 1865. To make such information available was a basic purpose in writing this dissertation. The sources of information were newspapers, magazines, programs, music scores, histories, biographies, and other writings on music in Richmond. The greater portion of the material was obtained from the files of the Virginia State Library, the Valentine Museum, and the Virginia Historical Society in Richmond, Virginia and from the Library of Congress in Washington, D. C.

The material is presented in six chapters, five of which represent sequential periods of musical progress and growth in Richmond. The first chapter provides a background study of music in colonial Virginia. The second chapter concerns the period from the close of the

American Revolution to the end of the eighteenth century --a developmental period from which the city emerged as a center of culture in Virginia. The third chapter depicts Richmond as a center of culture and music activities during the first quarter of the nineteenth century, and chapters four and five present musical developments in the city during the two ensuing twenty year periods. The last chapter provides a summary of the material presented and reports the author's conclusions drawn from the study.

The material presented indicates that Virginians under British rule enjoyed a variety of musical pursuits which were principally of English origin and inspiration. After the American Revolution, Richmond developed its musical life under the influence of an English heritage and with talent and musical materials from England made feasible by the continued social and economic ties with the mother country. The English theatre apparently served as a nucleus of music activity in Richmond until after the first quarter of the nineteenth century, when a more cosmopolitan European influence permeated Richmond's musical life through the activities of itinerant European concert artists who toured America in large numbers during the mid-century period. European immigrants, especially those of German lineage, brought new talent and inspiration to Richmond during the mid-century period, which saw a large number of musicians apparently earning their livelihood as music teachers and performers. Increased acceptance of musical innovations in some churches is noted and persistent resistance to change is noted in others. Music activity reached a peak in quality and diversity during the decade preceding the Civil War, and native and immigrant southern talent continued to provide music to Richmond audiences through the Civil War period.

Each period of progress in Richmond is described with music topics presented under the headings of: (1) music on public and social occasions, (2) music merchantry and instruction, (3) music of the theatre, (4) concerts, and (5) music of the church. Appendices contain data on buildings--public places where music was performed--and representative concert programs presented in Richmond from 1797 through 1865.

Microfilm \$4.10; Xerox \$14.40. 320 pages.

MUSIC AND LANGUAGE: SOME RELATED ANALYTICAL TECHNIQUES.

(L. C. Card No. Mic 60-6336)

Joseph Edward Youngblood, Ph.D.
Indiana University, 1960

The purpose of this study is to describe certain techniques currently being used in linguistic analysis in terms of their applicability to musical analysis. Specifically, procedures used in the statistical, physical, and theoretical analysis of language are investigated.

The usefulness of information theory as a method of interpreting the statistical properties of melody was explored. Entropy, relative entropy, and redundancy were computed for a set of vocal melodies by Schubert, Mendelssohn, and Schumann, for the three composers as a group, and for four selections of Gregorian Chant. On the basis of these data, the two groups were compared.

An experiment was carried out in an attempt to determine directly the resonance of the trumpet, French horn, trombone, and tuba. A pure tone of constant intensity was swept through the tubings of these instruments, and the intensity of this tone as it came out of the instruments was graphed. Peak-resonance frequencies, peak intensities, and half-band-widths were determined. On the basis of the resulting figures, apparent similarities and dissimilarities among the instruments were accounted for.

In an effort to systematize the deduction of scales for primitive cultures, a method of scale-deduction based on distribution was outlined. The process of deriving a phonemic system from a phonetic system was described, and this process was applied to the deduction of a scale-system from a set of musical transcriptions.

Various other parallels between music and language were discussed, including complementarity, free variation, neutralization, standards of pronunciation and intonation, and method of portrayal. The study of music and language on the aesthetic level was discussed briefly.

Recommendations for further study were made in connection with each of the developed areas and in connection with the aesthetic studies.

Microfilm \$2.75; Xerox \$6.40. 135 pages.

PHARMACOLOGY

COMPARATIVE PHARMACOLOGY OF SOME PSYCHOPHARMACOLOGIC AND ANTICONVULSANT DRUGS

(L. C. Card No. Mic 60-6228)

Gregory Burnell Fink, Ph.D.
University of Utah, 1960

Co-Chairmen: E. A. Swinyard and S. C. Harvey

Eight psychopharmacologic drugs with tranquilizing properties (chlorpromazine, promazine, trifluorpromazine, thioridazine, reserpine, hydroxyzine, meprobamate, and

phenaglycodol) and four anticonvulsant drugs (diphenylhydantoin, phenacemide, phenobarbital, and trimethadione) were assayed by the following tests and procedures: median lethal dose, median neurotoxic dose, maximal audiogenic seizures (MAS), maximal electroshock seizures (MES), threshold for minimal seizures variously induced, a conditioned avoidance response, amphetamine toxicity in aggregated mice, and hexobarbital potentiation. In addition, drug effects on the brain concentration of gamma-aminobutyric acid were measured. The results obtained with the psychopharmacologic drugs were analyzed for anticonvulsant properties, and those with the anticonvulsant drugs for tranquilizing properties. Finally, the

various drugs were categorized on the basis of their profiles of action as revealed by the above tests.

The duration of the components of MAS and MES were measured and the seizure patterns compared. The major feature of both MAS and MES is a tonic convulsion characterized by initial flexion and subsequent extension of the hindlegs. MAS differs from MES in that appreciable latency, wild running, and clonus precede the tonic components. Chlorpromazine, promazine, triflupromazine, and thioridazine lacked ability to prevent the running component of MAS or the tonic-extensor component of MES, but prevented MAS tonic-extension in doses near the neurotoxic level. Reserpine actually increased seizure severity, decreased MES latency, and nearly all reserpine-treated mice died following the seizure. In non-toxic doses, meprobamate, phenaglycodol, and the anticonvulsant drugs prevented MAS running and MAS and MES tonic-extension, and increased the latency of MAS and MES.

The phenothiazines, reserpine, and hydroxyzine either had no effect or lowered the threshold for minimal seizures induced by alternating current, low-frequency electroshock, and Metrazol. Meprobamate, phenaglycodol, and the anticonvulsant drugs raised such thresholds.

Conditioned avoidance responses were developed in mice. Drugs were tested for ability to block the secondary conditioned response (SCR, exposure to the environment), the conditioned response (CR, exposure to buzzer and light), and the unconditioned response (UR, exposure to electric shock). In non-toxic doses, the phenothiazines, reserpine, and hydroxyzine specifically blocked the SCR and CR. The substituted diols and anticonvulsant drugs had little effect on conditioned responses.

The phenothiazines were the only agents effective against amphetamine toxicity in mice aggregated 3 per cage. The phenothiazines, reserpine, hydroxyzine, and two anticonvulsant drugs (diphenylhydantoin and phenacemide) were effective against amphetamine toxicity in mice

aggregated 10 per cage. Meprobamate, phenaglycodol, phenobarbital, and trimethadione were not effective by either test. All of the drugs tested increased hexobarbital sleep time.

Drug effects on the concentration of gamma-aminobutyric acid (GABA) and other free amino acids of the mouse brain were measured by two-dimensional paper chromatography. No correlation was found between brain GABA concentration and brain excitability when the drugs were administered at dose levels which produced a significant effect on seizure threshold.

The data indicate that the 12 agents tested may be divided into 3 distinct groups: (1) the tranquilizers, chlorpromazine, promazine, triflupromazine, thioridazine, reserpine, and hydroxyzine, (2) the sedative anticonvulsants, meprobamate, phenaglycodol, phenobarbital, and trimethadione, and (3) the non-sedative anticonvulsants, diphenylhydantoin and phenacemide. The tranquilizers are characterized by their lack of anticonvulsant activity, tendency to lower seizure threshold, and ability to block a conditioned avoidance response and to reduce amphetamine toxicity in aggregated mice. The sedative anticonvulsant drugs are characterized by effects which are converse to those of the tranquilizers. Meprobamate and phenaglycodol are characterized by actions which resemble those of the sedative anticonvulsant drugs rather than the tranquilizers. Although the non-sedative anticonvulsant drugs do not block conditioned avoidance responses, they do reduce amphetamine toxicity in aggregated mice and prolong hexobarbital sleep time. This suggests that these drugs have some tranquilizing properties and may be useful in the treatment of mentally-ill patients. The results obtained with this battery of tests, and the classification of the drugs into the 3 groups, may be correlated with available clinical data.

Microfilm \$2.75; Xerox \$5.80. 118 pages.

PHILOSOPHY

RADHAKRISHNAN AND INTEGRAL EXPERIENCE

(L. C. Card No. Mic 61-244)

John Geeverghese Arapura, Ph.D.
Columbia University, 1960

Sarvepalli Radhakrishnan can, with equal plausibility, be studied from different points of view. He is at the same time comparative philosopher, historian of Indian Philosophy and philosopher of religion. There is a unity that reveals itself in and through the various roles that Radhakrishnan plays as a philosopher. This unity exists because he has a special philosophy of his own: this is what Integral Experience is.

Integral Experience is a new reconstruction of the perennial philosophy. In reconstructing the perennial philosophy, Radhakrishnan, like several others, is responding to the agnostic challenge of Kant, who has a pivotal place in modern philosophy. Radhakrishnan accepts

Advaita Vedanta as the model type of the perennial philosophy, in that it expresses the doctrine of the self-evident knowledge of unconditioned reality in the most positive terms. But Radhakrishnan feels that there is need to interpret the doctrine of self-evidence in terms of the integral nature of the human mind, for reality too is integral. The mystical faculty is the heart of the human mind, while it is enriched by reason and what is ordinarily called intuition, but more properly to be called feeling.

Attention, therefore, is turned to the methodology of integral experience. The three elements, reason, intuition and mystical experience are remoulded into components of integral experience. The power of the mind to know reality consists in the integrity of the three faculties; if these faculties move away from, rather than towards, one another the minds' integrity will be lost. In the re-discovery of the unity of the knowing apparatus, the genuine, common elements of intuition are made use of. All knowledge must culminate in mysticism, but mysticism

by itself and in isolation from the other elements can never be trusted to deliver knowledge of reality. Thus Integral Experience is presented and developed as a new type of mystical epistemology. At the same time, it is a critique of mystic experience and of religion. The task is to separate the inner essence of religion - what is universal and timeless - from the outer structures. Integral Experience is advanced as a new metaphysics of religion.

The method of Integral Experience is applied to the concrete realms of science, art and ethics. In all these realms, an acute effort is made to separate inner essences from outer structures. The application of the method to these realms yields interesting results, but the actual, systematic value is minimized as there is a constant transfiguration of the natural to the supernatural and the normal to the supernormal. The genius, the mystic, the moral hero and the saint are set up as the answers to critical inquiry in their respective realms. Yet, the possibility of Integral Experience being developed into a universe of the various universes of discourse is recognized. The central problem is always self-evident knowledge. Interesting transformations of the vedantic doctrines of self, consciousness and reality result in the course of developing Integral Experience as an interpretation of advaita vedanta. Radhakrishnan seeks to substitute the dogmatism of Advaita Vedanta, both in terms of its insistence on the scriptures and in terms of the logic of the axiom of self-evidence, with an empirical basis. In doing this Radhakrishnan has made great gains in speculation but has at the same time made his position more vulnerable. Self-evident knowledge as the result of some consummatory experience or realization is open to criticism. Yet, Radhakrishnan's philosophy of integral experience has the great merit of offering us an adequate and wholesome vision of life.

Microfilm \$4.50; Xerox \$15.75. 350 pages.

REASON AS A NATURAL FUNCTION IN THE PHILOSOPHY OF JOHN DEWEY

(L. C. Card No. Mic 61-97)

Jack Cloyd Carloye, Ph.D.
University of Illinois, 1960

In my thesis, I discuss Dewey's theory of reason as a natural function under three headings, constituting the subject-matter of the three main parts of the thesis. These headings are: I. that reason is continuous with nature and evolves out of nature; II. that the forms of reason are natural forms; and III. that the objects of reason are natural objects. These headings reflect the stages of development of the subject-matter of rational inquiry: the first heading reflecting the stage in which the subject-matter constitutes the antecedent conditions of inquiry; the second reflecting the stage in which the subject-matter constitutes the contents of propositions and functions as means to the end of inquiry; and the third reflecting the stage in which the subject-matter is given rational form and becomes an object of judgment.

Under the heading of the continuity of nature and reason, I discuss two views of this continuity. The first is described as an ideal objective view in which nature is

represented as levels of events and of interactions constituting the subject-matter of events ranging from the lower level of physical events to the higher level of social events. Social events are related through intelligence. The second view of nature and its continuity with reason represents nature as levels of an environment for an organism, these levels ranging from excitations to social habits, or customs, involving intelligence. These two views represent the grounds of continuity in nature as two different concepts of causality. Events are not actively interrelated, but their "interactions" are constituted by logical causality, i.e. ordered sequences. Active relations are all of the nature of production for Dewey. Production is referred to as existential causality, and consist in the activity of informing subject-matter. The agent is a form; and basically the ground for all active forms is an organism. The synthesis of the two views of nature is a theory of evolution in which nature is represented as two dimensional. The first dimension consists in two parallel sequences of organisms and their environments. Each of these is ordered sequentially from simple to complex. The second dimension is the interaction between the two parallel sequences, and this dimension includes the active, existential sense of causality. The results of this analysis are shown to be a series of situations ordered very much like monads in Leibnitz' monadology. These results are then applied to Dewey's theory of communication, and the nature of a "shared" social situation is explained.

Under the second heading I discuss Dewey's theory of propositions. I distinguish existential and conceptual propositions and the sub-types under these; and also the correlation of the two types of propositions. The results of these discussions are then used to resolve the apparently contradictory claims which Dewey makes for logic; namely, that it is autonomous and yet that it is a natural science having its own subject-matter which is continuous with the subject-matter of the other sciences. In the course of the resolution of this conflict, I indicate the continuity of existential propositions with existence, and the continuity of conceptual propositions with an ideal system defined by the canons of logic and modelled by mathematics.

Finally, under the third heading I am concerned with the two dimensions of judgment, temporal and logical; with the correlation of judgment with its object; and with the theory of truth which Dewey's analysis of the nature of judgment requires. My conclusion is that truth is not defined in Dewey's philosophy either as correspondence to existence, or, directly, by the test of consequences. Truth is defined by relation to a limiting ideal.

Microfilm \$3.30; Xerox \$11.70. 256 pages.

THE LOGIC OF IACOPO ZABARELLA (1533-1589)

(L. C. Card No. Mic 61-247)

William F. Edwards, Ph.D.
Columbia University, 1960

Count Iacopo Zabarella (1533-89) taught first logic and then natural philosophy at the University of Padua from 1564 to his death in 1589. An Aristotelian, he produced

two major works: an *Opera Logica* (Venice: 1578), which contains a *De Methodis*, one of the earliest treatments of the modern concept of scientific method under that name; and a *De Rebus Naturalibus* (Venice: 1590), an encyclopedic volume on the chief problems of natural science as it existed in the late 16th century, and containing (among other things) a work on the problem of motion and a naturalistic epistemology and psychology. Zabarella also published a commentary on the *Posterior Analytics* (Venice: 1582), among the three or four best and clearest commentaries that have been written on that work; a *De Doctrinae Ordine Apologia* (Padua: 1584), written in defence of the theory of pedagogical method contained in his earlier *De Methodis* which had come under attack by Francesco Piccolomini (1520-1604); and a collection of *Tabulae Logicae* (Padua: 1580). Posthumously published were commentaries on the *Physics* (Venice: 1601) and the *De Anima* (Venice: 1605).

As its title indicates, this dissertation is devoted almost entirely to a study of Zabarella's *Opera Logica*, which was the work of his that aroused the most interest in the 16th century, and -- because of the strikingly modern theory of scientific method it presents -- is still the one that is of the most interest to us, other than the psychological works contained in the *De Rebus Naturalibus*. The dissertation is organized mainly around four of the works of the nine that make up the *Opera Logica*: the *De Natura Logicae*, in which Zabarella sets forth a thoroughly instrumental concept of logic; the *De Methodis*, in which he attacks and reconstructs the theory of scientific method worked out by the long line of commentators on Galen's *Medical Art* from Pietro d'Abano to the leading *medici-philosophi* of the 16th century such as Nicolò Leoniceno (1428-1524), Giovanni Battista Montano (1488-1551), and Oddo degli Oddi (1478-1558), and outlines his own concept of a resolute and a compositive (or demonstrative) method; the *De Regressu*, in which he shows in detail how resolute and compositive method are to be employed in the natural sciences, the former for the discovery of causes through sensible effects, and the latter for a scientific knowledge of effects through the causes discovered by resolution; and the *De Medio Demonstrationis*, in which the most significant questions are whether formal and final causes can be the middle terms in scientific demonstrations. These four works taken together provide us with what was essentially the 17th century, or Galilean, concept of scientific method, the only missing element being mathematics, which Zabarella as a product of the non-mathematical medical-philosophical tradition of the Renaissance takes no account of in his methodology. Following the leads supplied by Prof. John Herman Randall, Jr., in his "The Development of Scientific Method in the School of Padua" (*Journal of the History of Ideas*, Vol. I, 1940, pp. 177-206), the relationship of Zabarella's methodological thought to that of Galileo is further explored, as well as Zabarella's influence in 17th century Protestant Germany, and in general the program of the dissertation is to investigate more closely than Prof. Randall was able in his pioneer monograph on Padua to do the immediate 16th century background and impact of Zabarella's logical and methodological theory.

Microfilm \$5.20; Xerox \$18.25. 405 pages.

FUTURE TRUTH: SOME METAPHYSICAL PUZZLES.

(L. C. Card No. Mic 60-6738)

John King-Farlow, Ph.D.
Stanford University, 1960

A Statement of the Main Problems: Aristotle or a disciple declared that the sentence 'there will be a sea-fight tomorrow' was neither true nor false; for, if it were true or false, the sea-fight would necessarily have to happen or not to happen. C. D. Broad once withheld truth values from all sentences about the future; this, he felt, was demanded by the fact that Time involves change and a definite direction. The main problems of the dissertation are these: (a) Would we be correct to restrict or eliminate truth values in the case of statements about the future? (b) Are the reasons given for doing this good ones? (c) Is there something special about the future which lends support to those who answer 'yes' to (a) and (b)?

Procedure: Chapter One, Sections Two to Seven expound and analyse the views of Aristotle (s 2); Gilbert Ryle (s 3); C. D. Broad and J. McTaggart (s 4); Donald Williams (s 5); J. Lukasiewicz and C. A. Baylis (s 6); Richard Taylor and Rogers Albritton (s 7). Chapter Two, Section One, is devoted to A. N. Prior, Section Two to a brief sketch of Diodorus' Master Argument and Section Three to D. F. Pears on 'the unreality of timelessness.' Chapter One, Section Eight and Chapter Two, Sections Four and Five offer some independent analysis of the problems. Chapter One, Section One and Chapter Two, Section Six attempt to justify my describing these problems and their treatment here as 'metaphysical.'

Main conclusions: (a) The standard logical method whereby truths are treated as timeless makes for a far clearer and simpler logic than does the time-relative treatment of Aristotle and Prior; (b) but this is not, as Williams believes, a compelling argument for metaphysical belief in the symmetry of space and time; (c) whatever 'indeterminism' and 'free will' may mean, the authors considered give no effective proof that these are incompatible with timeless truths, nor does there seem to be such a proof; (d) the libertarian opponents of future truth have also failed to see that a version of rigid determinism is compatible with belief in the unreality of the future, hence their fear of future truth is doubly erroneous; (e) Broad like McTaggart does not grasp that the relations 'earlier than' and 'later than' are quite adequate to express the factor of change essential to time -- hence McTaggart's argument against the reality of time and Broad's attack on future truths in order to save time from McTaggart are both misconceived; (f) Though the reasons considered for looking upon the future as unreal are fallacious, this does not mean that a metaphysician may not consider the future *unreal* in several senses and express his metaphysical picture by banning future truths; (g) Ryle's qualms about reference to future entities, as we have not 'got them' to refer to, fits in well with such an asymmetrical picture but lack point otherwise; (h) we can construct somewhat awkward correspondence theories of truth which do rough justice to Broad's or Aristotle's asymmetry of time and space -- the question remains whether they would want to persevere with such an asymmetry once they grasped the simple and innocuous character of timeless truth.

Microfilm \$2.95; Xerox \$10.35. 228 pages.

THE MORAL PHILOSOPHY OF KARL JASPERS

(L. C. Card No. Mic 60-6314)

Richard Mills Owsley, Ph.D.
Indiana University, 1960

The conclusion of this paper is that the approach of Karl Jaspers to Being, to meaning, and to experience is fundamentally moral rather than ontological, psychological, logical, or phenomenological. Morality is, for him, the propaedeutic to metaphysics, to history, and to methodology. Moral philosophy may be defined as the study of persons, their points of view, and their reflective choices. The three foci of moral studies for philosophy have each dominated a period in the development of Jaspers' thought. His early psychological, biographical, and autobiographical pursuits each revolved around the phenomenological interpretation of persons. Not only are the clear ideas of persons examined but an attempt is made to interpret the vagueness, the ambiguity, and the paradoxical aspects of thought, feeling, and acting. Points of view are interpreted in a consideration of the modes of the spirit, and in the specific studies of artistic creations, mythological fantasies, scientific imaginings, and philosophical speculation. Reflective choices are illuminated in the concrete philosophical interpretations of the conditions of freedom, individual, social, political, and metaphysical.

In addition, to an outline of Jaspers as a moral philosopher, this paper contains an attempt to answer four types of criticism of the conclusion. Jaspers has been charged with the denial of morality, relativism in morality, inconsistency in morality, and narrowness in morality. In attempting to answer these attacks, the procedure of the dissertation is as follows: Chapter I examines the presuppositions of Jaspers' philosophical method; Chapter II examines Jaspers' moral philosophy in relation to Nietzsche and Kierkegaard. These two are to Jaspers exemplary human beings or "exceptions." It is through the appropriation of their goals, categories, and self-consciousness that Jaspers believes philosophy can become moral; Chapter III discusses moral philosophy as it relates to the principles and the results of the investigation of man. The moral philosopher investigates man individually or collectively by concentrating upon what the individual may become rather than what man "is" or "was." Chapter IV considers moral consciousness in connection with science, art, and religion. An examination of the variety of the modes of the spirit in context, partially removes the arbitrariness of morality; Chapter V through VIII attempt to provide evidence for adequacy of Jaspers' moral conclusions. Chapter V outlines Jaspers' moral emphasis with regard to man-in-the-world; Chapter VI attempts to do the same for the communication of one individual with another; Chapter VII analyzes the autonomous self in his political and social context; Chapter VIII considers the moral interrelationship between man and God.

The conclusions of Jaspers pertaining to moral philosophy consists of two parts; first, a negative rejection of the peripheral in the person, and second, an accurate description of the Existential in man. Without both of these emphases the philosopher cannot discern the authentic from the inauthentic. Philosophizing prepares the individual for this discernment. That which gives the

moral philosophy of Jaspers its qualities of unity, consistency, intensity, and adequacy is the recurrence of five themes which serve as the basis of that philosophy.

(1) Philosophy is the search for Being, and morality is the preparation for the search. (2) Being is reflected in the individual human being, and therefore philosophy is rooted in the study of personality. (3) Values are always personal. The significance of any situation is the emergence of freedom, in concrete persons. (4) Moral philosophy concerns itself with the directions in which free persons go beyond themselves toward the world, toward others, or toward God. (5) There is a continuous conversion of the person who realizes freedom, communication, and Transcendence from within a concrete historical context. Microfilm \$4.10; Xerox \$14.40. 320 pages.

TOWARD PHILOSOPHICAL DIALOGUE AS PHILOSOPHY OF CULTURE

(L. C. Card No. Mic 60-6582)

Esther Cornelius Swenson, Ph.D.
Northwestern University, 1960

The issue motivating this work is the concern for philosophy in a revolutionary age. The primary assumption underlying the writing is that to become a philosopher is in essence to make a choice as to the nature of philosophy itself. But each one who so chooses gives concrete meaning to the word "responsible." This word can have many kinds of meaning. Three of the primary ones are (i) intellectual responsibility, (ii) moral responsibility, and (iii) religious responsibility. Since the concern of this work, however, is for philosophy in a critical age, the moral and religious meanings of the word are presupposed. The major attention is directed toward the attempt to discover a meaning to the words "intellectually responsible." Such an intent is focused upon two questions: (i) "What is the nature of philosophical dialogue?" and (ii) "How is it relevant to this age?"

In order to structure a philosophy which will be relevant to this age it was deemed necessary to investigate a philosopher whose thought had as its purpose speaking to a given crisis. At the same time, it was believed that the one studied should be a thinker whose understanding of his own age would illuminate the present time. This choice was that of Soren Kierkegaard. Kierkegaard's whole philosophy can be seen as the attempt to state the way in which a thinker can speak responsibly to a given critical age.

Part One of the dissertation is an attempt to discover the exact nature of the crisis of Kierkegaard's age. He saw it as a religious crisis: man thought himself to be religious, but in reality he lived in non-religious categories. Kierkegaard set out to understand how this emptiness of the religious aspect of life came about. He accomplished this understanding through an analysis of man as spirit and as self-conscious being. It was seen that a certain way of knowing, when turned upon oneself, is destructive of the religious way of life.

Part Two is an attempt to discover the manner in which Kierkegaard believed he was to speak to his age. Since he saw his task as that of deceiving people into being

religious, and especially into being Christian, he felt called upon to employ many forms: pseudonymity, anonymity, indirect communication, and experiment are some of the most important of these. In this Part, these notions are explored under the understanding of his task as threefold: as subjective thinker, as leveller, and as edifier.

The Conclusion to the work is an attempt to arrive at an answer to the guiding questions of the dissertation. This is done through a critical discussion of Kierkegaard's thought as revealed in Parts One and Two. Philosophical dialogue is discussed in its nature as dialogue for knowl-

edge and in its nature as dialogue for decision. The object of such dialogue is disclosed as man in his being. The other traditional philosophical questions, namely, the epistemological, the aesthetic, the ethical, and the cosmological questions, supplemented with the question of man as a technological being, are reintroduced into this context. The relevance of such dialogue is seen for our nihilistic age. And the result is a structuring of a philosophical dialogue as a philosophy of culture.

Microfilm \$3.95; Xerox \$13.95. 307 pages.

PHYSICS

PHYSICS, GENERAL

K ENERGY LEVELS OF COPPER AND CHROMIUM

(L. C. Card No. Mic 60-6605)

Charles Allen Belfi, Ph.D.
The University of Texas, 1960

Supervisor: Dr. Harold P. Hanson

Results of measurements to determine the influence of a bound-ejected electron on the K vacancy energy level are presented. A bound-ejected electron is an electron that has been transferred from an inner shell of an atom to an outer vacant orbit of that atom. Isochromats were recorded at the wavelengths of the maximum and half maximum intensities of the $K\alpha_1$ lines of copper and chromium. These isochromats included the K excitation potential in order to produce bound-ejected electrons. Isochromats were also taken near the high frequency limit.

A double crystal spectrometer and commercial x ray tubes were used. A high voltage circuit is described which decreases the problem of high voltage insulation considerably. The high voltage ripple was 4.2 volts peak to peak for copper and 3.2 volts peak to peak for chromium. However, with manual control, the maximum voltage of the high voltage ripple was regulated to within 0.0022%. Current regulation was maintained to better than 0.4% at 9.4 ma. A unipotential x ray tube cathode was approximated by center tapping the filament transformer to the high voltage supply.

A resume of the results of previous observations of structure in the energy spectrum near the high frequency limit and near the K excitation potential is presented. A calculation is given of the influence on the energy of copper $K\alpha_1$ x rays caused by an electron bound in the 4p orbit. The calculation utilizes hydrogenic wave functions and Slater shielding constants.

Isochromats taken near the high frequency limit at 9,000 volts showed structure. In the case of copper the intensity rose sharply for 6.1 volts as the high voltage was increased and then remained constant for a further increase of about 10 volts. The chromium isochromat rose sharply for 5.6 volts after which the intensity de-

creased for 4.4 volts. Isochromate of copper taken near the K excitation voltage showed a sharp increase in intensity which lasted for 2.9 volts. Further increase of the voltage produced a plateau 4.8 volts wide. Isochromats of chromium had an initial rise in intensity which occurred over 3.7 volts followed by a plateau which existed for about 7 volts. Structure in isochromats taken at the half maximum intensity was similar but less pronounced than the structure of isochromats recorded at the peak of the line.

Results are shown which indicate that no shift of the $K\alpha_1$ line occurs due to the presence of the bound-ejected electron. However, the width of the $K\alpha_1$ emission line was shown to be less than the accepted value when the high voltage was less than 5.3 ± 1 volts above the excitation voltage for copper and less than 1.2 ± 0.3 volts above the excitation voltage for chromium. It was suggested that the bound-ejected electron probably influences the fluorescent yield. Microfilm \$2.75; Xerox \$6.00. 124 pages.

EXPERIMENTAL AND THEORETICAL STUDIES OF IONOSPHERIC ECHO POLARIZATION OVER THE SWEEPED FREQUENCY RANGE 50-1000 kc/s

(L. C. Card No. Mic 61-31)

Herbert Neil Carlson, Ph.D.
The Pennsylvania State University, 1960

The polarization of the extraordinary echo (reflected at about $X = 1 + Y$) at ground level depends on the electron density distribution in the neighborhood of the height of the critical collision frequency, ν_c . When this distribution and the wave frequency place the $X = 1$ height below ν_c , then this echo is expected to be left-handed; if above, right-handed.

By varying the radio frequency this $X = 1$ height can be made to pass through the $\nu = \nu_c$ height and this should result in a change in sense of rotation of the echo field vectors. For the observation of this effect, equipment has been constructed which receives ionospheric echoes over the swept range of radio frequencies 50-1000 kc/s and

resolves them into their two circular components. This is accomplished with the technique of phase shifting and adding at a constant intermediate frequency. Circuits are designed for fast recovery since operation near the pulsed transmitter is necessary for radio frequency tracking.

Echoes are received on a pair of horizontal coplanar dipoles crossed at right angles and analysed with this equipment. The only quantity recorded is the algebraic sign of the difference between the two video signals representing the circular components, i.e., the direction of rotation of the echo field vectors. This information is displayed on a conventional ionogram as a trace that is then either lighter or darker than the background.

When electron density gradients are low enough, the echo from the $N = N_y$ level is found to change from left-handed to right-handed when the wave frequency is increased, as predicted theoretically. The $N = N_c$ echo appears near the middle of the frequency range and it is left-handed as expected. These echoes often overlap and interfere. When the overlap is slight, regular interference fringes appear as radio frequency is increased permitting a determination of the virtual height separation that agrees with, and is much more accurate than, the virtual height difference as measured by the time elapsed between reception of the echoes.

With extreme gradients, the E-layer echo polarization is found to change from left-handed to right-handed and back to left-handed just once with no measureable increase in group height. It is shown that a simple ionosphere model—a step function—is adequate for a qualitative explanation of these changes in sense of rotation.

It was found that the polarization of E-layer echoes frequently varies unsystematically. Antenna site effects can be ruled out as a cause of this and an explanation is offered that requires echoes that are double because of either high gradients or horizontal inhomogeneities.

Microfilm \$2.75; Xerox \$4.80. 94 pages.

THE CONSTRUCTION AND PROPERTIES OF NONEQUILIBRIUM GIBBSIAN ENSEMBLES

(L. C. Card No. Mic 61-503)

Robert Long Wen Chen, Ph.D.
Syracuse University, 1960

The study of irreversibility by means of Gibbs statistical method may proceed along one of the two lines. We may construct an ensemble for a system in isolation, thereby studying its internal relaxation processes. Alternatively, we may construct ensembles representative of systems in interaction with reservoirs. The present work concerns itself with the former procedure.

We inquire into the proper method of constructing ensembles (for an isolated system) under two main types of physical situations. In what we call the "first type," the system is deliberately set up in some nonequilibrium state, and then allowed to relax. The state is specified by means of a set of appropriately chosen macroscopic variables. We show that, for this type, the ensemble density is generally invariant to momenta reversal.-- i.e., The density at a microscopic state is the same as at its momenta-reversed, "mirror image" state. As a result,

the ensemble averages of the interesting macroscopic variables are invariant with respect to time-reversal. In what we call the "second type" of situation, the system in question possesses a certain past history, and is observed to be in some off-equilibrium state at the present. The construction of ensembles representative of this type of situation is in marked contrast to that of ensembles of the first type. Among other things, they no longer have the above-mentioned symmetry properties. We examine in detail the relationship of these types of ensembles to the phenomenological laws of relaxation processes.

The failure to appreciate the distinction between these two types of ensembles leads to a number of perplexing questions. In particular, we discuss the problem raised by Landau, Lifshitz and Mayer*-- that even in ensemble theory, microscopic reversibility would have led to the conclusion that the entropy of a closed system has decreased prior to observation. We show how this difficulty, along with others, can be avoided if ensembles are constructed properly.

*Landau, Lifshitz, *Statistical Physics*, English translation, Addison Wesley, (1958), Especially p. 30. J. E. Mayer, *COMMUNICATIONS ON PURE AND APPLIED MATHEMATICS*, February, 1955.

Microfilm \$2.75; Xerox \$3.00. 40 pages.

QUANTUM STATISTICAL PAIR DISTRIBUTION FUNCTION. GENERAL THEORY AND ITS APPLICATION TO THE ELECTRON GAS.

(L. C. Card No. Mic 61-415)

Shigeji Fujita, Ph.D.
University of Maryland, 1960

Supervisor: Dr. Elliott W. Montroll

A general theory for calculating the pair distribution function for a quantum statistical system is developed and applied to the electron gas.

A cluster integral expansion for the pair distribution function of both quantum and classical systems is derived. Each cluster integral is represented by a hybrid (toron diagram) between a Mayer graph and a Feynman diagram in position-reciprocal temperature space. Analysis of diagrams leads to a theorem that the pair distribution function in grand canonical ensemble can be expressed in terms of two-body propagators. Various techniques, which were originally devised for the quantum field theory, are used for the analysis. In particular, the modified interaction is introduced as a partial sum of certain sub-diagrams. It is shown that the simple chain approximation to the modified interaction is responsible for the transfer of a plasmon in the case of low temperature electron gas. The pair distribution function up to the first order in the modified interaction is calculated. A new expression which relates the internal energy with the pair distribution function is derived, assuming a system of many particles interacting through pair forces. This is used to calculate the ground-state energy of an electron gas. The result is in agreement with the work of Gell-Mann & Bruckner.

Microfilm \$2.75; Xerox \$5.40. 109 pages.

SPECIAL PROBLEMS IN ABSTRACT FIELD THEORY

(L. C. Card No. Mic 60-6555)

Peter B. Kahn, Ph.D.
Northwestern University, 1960

Director: Max Dresden

Before the introduction of the "abstract approach" to Quantum Field Theory one used the "renormalization procedure" to calculate those quantities which were to be compared with experiment. Although this technique was extremely successful in Quantum Electrodynamics, it could not be extended to include other theories. Also one was required to perform mathematical operations which not only could not be justified but were found to be inconsistent. Hence the abstract approach was developed. It sought to give a description of the theories from a postulational foundation, that is to say, one constructs a theory from a few basic postulates from which all the desired information is obtained. The framework is very broad and hence one imagined that one could find a model which would satisfy all these basic postulates. However, as yet no such example has been found.

We have considered two special applications of the abstract formulation, with the hope of better understanding the difficulties of Quantum Field Theory. Before considering these problems we derive the ϕ system of equations in a straight-forward manner without recourse to functional methods. This system explicitly reflects the interaction since the ϕ functions vanish as the interaction goes to zero. A knowledge of it is essential to test the consistency of approximation procedures. However, the system is unamenable to analysis due to its complexity. (It is an infinite set of coupled non-linear integral equations.)

Next we present a discussion of a four-dimensional massive analogue of the Glaser solution of the Thirring model. It was hoped that our model would be suitable to test the general requirements imposed on a theory as set forth by Lehmann, Symansik and Zimmermann. However, due to peculiarities in the structure of the phase matrix and the presence of super selection rules, we are not able to construct an interacting field which satisfied all the conditions imposed on a theory by the Lehmann, Symansik and Zimmermann formalism.

Finally we develop an abstract approach to Non-Relativistic Quantum Mechanics. We consider this problem in order to better understand the role played by the basic postulates in the theory and because of our desire to make use of the unitarity condition in Quantum Field Theory. The unitarity condition in Non-Relativistic Quantum Mechanics is simpler than in Quantum Field Theory, but is formally of the same nature. Hence we hope to gain insight into the more complex problems of Quantum Field Theory by studying the analogous problem non-relativistically.

The development of our theory including the reduction formulae is analogous to the development of Quantum Field Theory as put forth by Lehmann, Symansik and Zimmermann. We make the simplifying assumption that the one particle state is independent of the time. From this, it follows that the τ and ϕ systems are identical and linear, and ψ and ψ^+ must have their non-equal time commutator

a q. number. We give a discussion on the consistency of various commutators and the Hamiltonians which may be considered within our framework. We also demonstrate that it is impossible to construct a Hamiltonian theory which is Galilean invariant, and in which the number of particles is not conserved. However, if one imposes Euclidian Invariance plus translational invariance in time, one is not restricted to particle conserving theories, and since the results of our theory are valid for either invariance group, we can consider both potential and particle non-conserving theories.

Microfilm \$2.75; Xerox \$5.60. 112 pages.

STRICT LOCALIZATION IN QUANTUM FIELD THEORY

(L. C. Card No. Mic 61-422)

James Milton Knight, Ph.D.
University of Maryland, 1960

Supervisor: Professor John S. Toll

A definition of strict localization of states in quantum field theory is presented. This definition is based on considering products of field operators as the primary measurable quantities of the theory. An example of a localized state is given, showing that such a state arises when a free field interacts with an external current that is limited to a bounded region of space-time. It is shown by means of a graphical technique that a state having a finite number of particles cannot satisfy the definition of localization. A simple representation of localized states is investigated, and arguments are given to support its generality and uniqueness.

Microfilm \$2.75; Xerox \$3.00. 58 pages.

HIGH-ENERGY POTENTIAL SCATTERING

(L. C. Card No. Mic 61-454)

Philip James Lynch, Ph.D.
Iowa State University of Science and Technology, 1960

Supervisor: Bille C. Carlson

In this study of high-energy potential scattering, it is assumed that the scattering is mainly forward. This condition is satisfied if the potential energy is small in magnitude compared to the incident energy and the wavelength of the incident particle is small compared to the range of the potential. Subject to these restrictions, one can generalize a method devised by Tolhoek and De Groot for obtaining approximate wave functions of charged particles in constant electric or magnetic fields either parallel or perpendicular to the incident direction of motion. The generalized procedure is applicable to the case of variable, arbitrarily-oriented electric or magnetic fields. Approximate wave functions are obtained for both Schrödinger and Dirac particles; for a Schrödinger particle in an electric field, the procedure leads to Molière's wave function.

A systematic high-energy approximation procedure for the scattering amplitude requires an expression for the difference between the approximate wave function and the exact wave function ψ . For the case of a Schrödinger particle in a scalar potential, a new exact relation for ψ , with the approximate wave function as leading term, is obtained by applying Green's theorem to the exact Green's function and the approximate wave function. A high-energy form of the exact scattering amplitude follows directly. This latter expression can be rewritten in a form first obtained by Saxon and Schiff, and it may also be written in the form characteristic of a two-potential theory. The high-energy scattering amplitude is also obtained for two other cases: a spinless Schrödinger particle in a magnetic field and a Dirac particle in an electric field.

In addition, a high-energy time-dependent formulation of scattering theory is set up for the Schrödinger equation by means of an approximate time-development operator U_a . Approximate wave functions and approximate Green's functions for particles in electric and magnetic fields are derivable from the coordinate representation of this operator. When the potential is time-independent, integral equations for the exact time-development operator, with U_a as inhomogeneous term, lead to two time-independent equations for ψ . One is identical with the equation discussed in the last paragraph. The second is a complicated integral equation which goes over into the Saxon-Schiff integral equation for high energies.

Finally, the partial-wave analysis is discussed, with emphasis on high-energy formulas for phase shifts corresponding to small or large angular momentums. Also, an exact but unwieldy integral expression for any phase shift is obtained in terms of the WKB approximation for the radial wave function.

Microfilm \$2.75; Xerox \$7.20. 154 pages.

NUCLEAR MAGNETIC RELAXATION IN LIQUID HYDROGEN BROMIDE

(L. C. Card No. Mic 60-6992)

Jasper Durham Memory, Ph.D.
The University of North Carolina, 1960

Supervisor: Dr. Paul Stancyl Hubbard

An experimental and theoretical investigation of nuclear magnetic relaxation in liquid hydrogen bromide has been carried out. Intramolecular magnetic dipole-dipole interactions, electric quadrupole interactions, and a scalar spin-spin interaction were taken to be the relaxation mechanisms, and Redfield's density matrix formalism was used in the development of the theory. A chemical exchange phenomenon was found to be important, both through the fact that the scalar interaction receives a time dependence thereby, and also since by means of it, two different sites are available to the protons in which their relaxation rates differ, there being two stable bromine isotopes. The hydrogen bromide, gaseous at standard conditions, was liquefied by pressure and measurements were made at room temperature using standard spin echo apparatus. Both longitudinal and transverse magnetizations were found, to rather good approximation,

to have simple exponential decays, with relaxation times of 13.5 seconds and 1.14 seconds, respectively. The experimental and theoretical results were consistent.

Microfilm \$2.75; Xerox \$4.40. 81 pages.

POSITIVE PULSE THICKNESS OF A MACH 20-35 SHOCK WAVE IN AIR

(L. C. Card No. Mic 61-53)

Hillard Craig Miller, Ph.D.
The Pennsylvania State University, 1960

The potentials assumed by a cylindrical probe, as it is exposed to a shock wave propagating in a direction perpendicular to the probe, were measured for Mach 20-35 shock waves in air. The shock waves were generated by a conical electrode electromagnetic shock tube, sectional in design, constructed of $2\frac{1}{2}$ inch inside diameter brass tubing. The shock velocity was measured by means of ionization gauges. The probe potential was displayed on an oscilloscope and photographed for analysis. As the shock front approaches the probe, the probe potential is observed to decrease slowly from zero in a minimum V_0 . When the shock front reaches the probe the probe potential rises sharply over a short distance (positive Pulse Thickness-PPT) to a positive value, V_1 . The time of rise is labeled the Positive Pulse Duration (PPD). The probe potential then returns to zero in a time interval which is long compared to the time of rise. The influence of the shock tube wall upon the probe responses was unimportant for shocks stronger than Mach 20. The experimental results showed that in air the Positive Pulse Duration decreased steadily with increasing Mach number over the interval Mach 20-35. The experimental results also indicated that the Positive Pulse Thickness decreased slowly with increasing Mach number over the interval Mach 24-35. The following conclusions were reached. The observed behavior of the PPD and PPT is real, not a spurious effect caused by the external circuitry or the probe design. The Positive Pulse occurs at the time of arrival of the shock front at the probe. The observed dependence of the PPD (PPT) upon Mach number disagrees with the consensus of theoretical predictions as to the behavior of the shock thickness. Present theories predict that, over the observed range of shock strengths, the shock thickness is proportional to the Mach number of the shock raised to a positive power. Here if the Positive Pulse Thickness is proportional to the Mach number raised to some power, then that power is a negative number. The negative signal leading the shock front is known to be due to electrons. These electrons can arise either from diffusion from behind the shock front or from photoionization in the gas ahead of the shock caused by radiation from the shock. Both the diffusion hypothesis and the photoionization hypothesis can explain the sharp rise in the probe potential observed as the shock front passes. In the opinion of the author the photoionization hypothesis is to be preferred because it more readily explains the presence of the observed sharp probe potential gradients. The photoionization hypothesis provides for the presence of positive ions ahead of the shock front. Corresponding to the shock front there is a distance over which the positive

ions have a higher kinetic temperature than do the electrons. This distance, the Ion Equilibrium Length, corresponds to the proton cooling length in the work of Tidman on a shock wave in a proton-electron plasma. It is suggested that the Ion Equilibrium Length and the Positive Pulse Thickness are closely related, if not identical. It is concluded that more theoretical work as to the variation of shock thickness and Ion Equilibrium Length with shock velocity in real gases (i.e. gases capable of being ionized and/or dissociated) needs to be done. The installation of an electron beam densitometer in order to measure shock thickness directly over the same range of Mach numbers is recommended.

Microfilm \$2.75; Xerox \$3.60. 61 pages.

SMALL ANGLE X-RAY SCATTERING FROM RANDOMLY ORIENTED CYLINDERS OF ARBITRARY CROSS SECTION

(L. C. Card No. Mic 60-6815)

Melville Howard Akeley Miller, Ph.D.
University of Missouri, 1960

Supervisor: Paul W. Schmidt

Theoretically calculated scattering curves for particles of known shape and size are useful in interpreting small angle x-ray scattering data to determine the shape and size of the colloidal particles. This thesis deals with asymptotic methods which are appropriate in calculating the theoretical curves at the larger angles of the small angle scattering region.

For a sample consisting of identical, randomly oriented and positioned particles, each with uniform electronic density, maximum diameter D_3 , and volume V , the intensity of x-rays of wavelength λ scattered at angle 2θ is

$$i(h) = \frac{1}{V} \int_0^{D_3} dr 4\pi r^2 \gamma_0(r) \frac{\sin hr}{hr}, \quad (1)$$

where $h = 4\pi \lambda^{-1} \sin \theta$ and $\gamma_0(r)$ is the characteristic function of the intraparticle distance r . The discussion is limited to convex particles.

Successive partial integrations may be made of (1) to obtain a series of terms in increasing inverse powers of h . The number of times such partial integration may be meaningfully applied depends on the continuity and integrability of the derivatives of $H(r) \equiv r\gamma_0(r)$ which are involved. This is indicative of the importance of the analytic properties of $\gamma_0(r)$ or of $H(r)$ and of their derivatives. Treatment of these properties for an arbitrary particle shape is too complicated to be possible as yet. Cylinders (right cylinders of any convex cross section) were chosen as the subject of this investigation.

The characteristic function $\gamma_0(r)$ for the rectangular parallelepiped (R. P.) was obtained. We find that $\gamma_0''(r)$ has finite discontinuities at the values of r equal to the length, width, and height of the R. P.

For all convex particles γ_0 and γ_0' are continuous, and $\gamma_0(D_3) = \gamma_0'(D_3) = 0$. Two partial integrations of (1) for a particle whose characteristic function has n pieces $\gamma_{0i}(r)$, $r_i \leq r \leq r_{i+1}$, $i = 0, 1, \dots, n$ yields

$$i(h) = \frac{4\pi}{V} \frac{1}{h^4} \left\{ -2\gamma_{00}'(0) - \sum_{i=1}^n r_i \left(\gamma_{0i}''(r_i) - \gamma_{0(i-1)}''(r_i) \right) \cos hr_i - \sum_{i=0}^n \int_{r_i}^{r_{i+1}} dr [r\gamma_{0i}(r)]'' \cos hr \right\}. \quad (2)$$

Finite discontinuities in γ_0'' for the R. P. establish the existence of oscillatory terms of order h^{-4} in the integrated portion of (2). Integration of the integral remainder for the R. P. is possible with a theorem due to A. Erdélyi. Useful evaluation by this theorem seems to be limited to R. P. whose dimensions are not too unequal.

Possible discontinuities in $H(r)$ and its derivatives are investigated for all cylinders. Finite discontinuities like those which occur in γ_0'' for the R. P. are examined both analytically and geometrically. For the circular cylinder $H''(r)$ and $H'''(r)$ have, respectively, integrable and non-integrable infinite discontinuities, so that (2) is not valid for the right circular cylinder.

For cylindrical particles (1) may be re-expressed as

$$i(h) = \frac{4\pi}{V} \int_0^1 ds s \beta_0(s) \int_0^1 dt \alpha_0(t) \frac{\sin hL \sqrt{s^2 + v^2 t^2}}{hL \sqrt{s^2 + v^2 t^2}} \quad (3)$$

where L is the maximum diameter of the cross section and vL is the axial length, and where $\alpha_0(t)$ and $\beta_0(s)$ are the one and two dimensional characteristic functions for the axis and the cross section of the cylinder, respectively. For large elongation v , equation (3) may be partially integrated with respect to t to obtain a series of terms in increasing inverse powers of both h and v . For large enough h , this expansion establishes inverse fourth power dependence on h for all such elongated cylinders. This expansion is believed valid for all convex cross sections.

This series gives the same expansion as that due to A. R. Stokes (1957) for prisms when a series evaluation is made of some of its terms. The approach used here enables a more direct assessment of the error involved in the use of the Stokes form.

Microfilm \$2.75; Xerox \$8.40. 181 pages.

A STATIONARY GIBBSIAN ENSEMBLE

(L. C. Card No. Mic 61-521)

Walter Louis Sadowski, Ph.D.
Syracuse University, 1960

The Bergmann - Lebowitz equation is derived by integrating the Liouville equation over domains of collision of system particles with those of the reservoir. Thereby a more direct insight is afforded into the physical aspects of the Bergmann - Lebowitz equation.

On the basis of a specific physical model the stationary non-equilibrium distribution function is investigated.

The kernel of the non-equilibrium problem is expanded in a power series of the temperature difference across the system. The expansion obtained contains the temperatures of the two reservoirs in the zeroth-order of the distribution function. The resulting zeroth-order distribution

function contains numerical factors which make it slightly different from the equilibrium distribution. The physical significance of these factors is discussed.

A specific property of the perturbative kernel is used to find the approximate solution to the first-order perturbative equation. The result is an approximate solution since certain boundary conditions are not satisfied exactly. The error incurred is estimated to be small. An estimate is given. The error can be neglected under the conditions that the temperature difference between the reservoirs is small and the system is long.

The one-particle distribution function in μ -space is obtained by integrating the first-order n -particle distribution function. An expression is given for the transport of heat along the system's axis. It is shown that the resulting heat flux is proportional to where $Q_2 - Q_1$ is the length of the system's container along the axis of symmetry. This result is obtained without the usual assumption of local equilibrium or the assumption that a local temperature can be defined.

Microfilm \$2.75; Xerox \$3.60. 61 pages.

AN INVESTIGATION OF THE FOUNDATIONS OF QUANTUM ELECTRODYNAMICS

(L. C. Card No. Mic 60-3303)

Frederick G. Werner, Ph.D.
University of Cincinnati, 1960

What is electricity? What are elementary electric charges? What is magnetism? What establishes equilibrium?

In relativity theory and quantum theory, ideas of physical space and time and of state and process were sharpened and adjusted in the fruitful application of reason to experience in successfully overcoming in each case apparently insurmountable barriers to human understanding. Being outgrowths of classical mechanics, both theories have a common background, particularly when it comes to their interpretation in which the experimental arrangements and results of experiments must be capable of unambiguous description. Being outgrowths in quite different directions, however, developed to cope with quite different kinds of inadequacies of classical mechanics, these theories rest in some ways on quite different foundations.

Here we investigate these foundations in preparation for a great adventure: the development from unified foundations of a single theory of "quantumelectrodynamics" containing within its scope the physical content of both former theories and leading to a broader, deeper understanding of experience.

A theory combining quantum and electrodynamic theory should have as a consequence the fine-structure constant, $\alpha \equiv e^2/\hbar c = 1/137.04$, which is independent of the various characteristic lengths and masses of the variety of observed particles. Such a theory should not be founded on the postulate of rigid bodies whose rigidity is a consequence of, among other things, the existence of α . The idea of length in physics goes back to rigid bodies.

How much can be understood about the consequences of a quantum of "action" together with a characteristic

"velocity" within the limitations of the conservative principle that no assumptions regarding metric geometry or fundamental length are to be made until called for?

Of course, "ordinary" interpretation of theoretical results may still involve phenomenological use of "metrics." The constants \hbar and c occur in present theories in connection with free particle motion and free field propagation, while e appears in connection with the interaction between charged particles and electromagnetic field.

What is physical interaction? In present-day physics "contact interaction" is treated phenomenologically by taking empirically the so-called coupling constant between electromagnetic field and charged particles.

A statement that a system is separable is a restriction of physical interaction. Physical geometry depends on the principle of separability.

We consider quantum limitations on the significance of the classical concepts of separability and "value of a field variable at a space-time point."

INTERACTION IS MORE FUNDAMENTAL THAN SPACE. We look on geometries as tools to be developed and exploited as the occasion demands, and modified or thrown aside when inappropriate.

Ordinary space and time in physics are only a particularly convenient way to give a systematic description of the gross results of electromagnetic interaction in the classical limit.

We suggest a whole hierarchy of physical geometries, each most appropriate when a particular interaction is overwhelmingly predominant, each having room for description of other interactions vestigially as foreign elements and residually as partial destroyers of symmetries.

Minkowskian space-time description involves free, independent light signals and clocks. We suggest a geometry involving quantum limitations on separability of spatially distant photons.

Three so-far unconnected experimental distinctions between electricity and magnetism suggest distinct electric and magnetic subgeometries.

In the absence of interaction quantum mechanics deals with the whole configuration space of the whole system. The extreme effect of interaction is to collapse the effective dimensionality of the configuration space.

We suggest a treatment of dimensionality of geometrical space as physical variable, \square .

We think of charge and electromagnetic field as different manifestations of one basic "Stuff," which permits itself to be partially, but not completely, subdivided into partially but not completely separable entities.

Microfilm \$2.75; Xerox \$4.60. 87 pages.

PHYSICS, ELECTRONICS AND
ELECTRICITYINVESTIGATIONS OF NOISE REDUCTION
IN ELECTRON BEAMS BY MEANS OF
LOW-POTENTIAL REGIONS

(L. C. Card No. Mic 60-6746)

Alan W. Shaw, Ph.D.
Stanford University, 1960

This report concerns a mechanism of noise reduction in traveling-wave and backward-wave tubes. The noise-reduction comes about when an electron beam is passed through a low-potential region of the appropriate shape directly in front of the cathode. An analysis of a beam drifting at a low potential, and an experimental X-band tube in which a noise figure of 4.5 db was obtained, are both discussed.

The analysis used the density-function method with the following assumptions:

1. One-dimensional model. (This assumption is relaxed in the appendix where a simple two-dimensional model is analyzed.)
2. Full uncorrelated shot noise in each velocity class at the input plane (i.e., cathode followed immediately by a velocity jump to the drift potential).
3. No short-range collisions.
4. Linearized equations.
5. Rectangular d-c velocity distribution.

Expressions are found for the noise quantities, $\Phi(\omega)$, $\psi(\omega)$, $\Pi(\omega)$, and $\Lambda(\omega)$ in closed form involving integrals which require numerical integration. These quantities, along with the noise quantities S and $S - \Pi$ are plotted as a function of distance for various values of the parameters w_s , the normalized beam potential, and a , the normalized frequency. The noise figure of a TWT is given by the expression $F = 1 + 2\pi(S - \Pi)/kT$ so the noise figure depends directly on $S - \Pi$. The curves show a substantial reduction in this quantity for the appropriate drift distance and beam parameters.

An experimental low-noise TWT was constructed with a special gun in which the potential near the cathode could be closely controlled. The potential was adjusted experimentally to give minimum noise figure. Curves of noise figure and gain-versus-frequency are given. The shape of the potential near the cathode was measured and found to be different from a drifting region.

Microfilm \$2.75; Xerox \$5.60. 111 pages.

PHYSICS, NUCLEAR

ELECTRON SCATTERING
FROM THE ALPHA PARTICLE

(L. C. Card No. Mic 60-6721)

George Robert Burleson, Ph.D.
Stanford University, 1960PART I. AN EXPERIMENTAL SEARCH FOR
ANOMALOUS ELECTRON DIPOLE
STRUCTURE

It is possible for the electron to have either an electric dipole moment of magnitude $\lambda(q)$ or an anomalous magnetic dipole moment of magnitude $\mu(q)$ not arising from radiative corrections. The existence of the electric moment would constitute a violation of space-reflection and time-reversal invariance. In principle, these two moments should be considered functions of the four-momentum transfer q involved in an interaction in which the electron participates; this dependence corresponds to a nonlocal interaction in coordinate space.

In elastic electron scattering from the He^4 nucleus, the effect of these moments upon the expression for the cross section is to introduce a term proportional to $q^2 \alpha^2(q)$, where $\alpha^2(q) \equiv [\lambda^2(q) + \mu^2(q)]$, which has an angular dependence differing from that given by pure charge scattering.

By measuring absolute values of these cross sections at laboratory angles of 60° and 135° for five values of q , an experimental limit on $\alpha(q)$ has been found.

Cooled, compressed helium gas was used as the target material, and a ten-channel array of counter telescopes was used with a double-focussing spectrometer as the detector. Absolute cross sections were found for each point by comparison with elastic scattering from the proton, for which the absolute cross sections have been measured, using hydrogen gas as the target material.

Corrections were applied to the data for detector efficiency variation, for target density variation, and for electron radiation in the target material and in the Coulomb field of the scatterer.

The limit found is $\alpha(q) \leq 2 \times 10^{-4}$, in units of the charge on the electron times its Compton wavelength, for $q \leq 2.25 \text{ fermi}^{-1}$.

If it is assumed that $\alpha(q) = 0$, the scattering corresponds to that from a Gaussian charge distribution for the He^4 nucleus having a root-mean-square radius of $(1.68 \pm 0.04) \text{ fermi}$.

PART II. INELASTIC ELECTRON SCATTERING
FROM THE ALPHA PARTICLE

The inelastic scattering of electrons from He^4 which corresponds to a disintegration of the nucleus has been studied for incident electron energies of 400 and 500 Mev at laboratory angles from 45° to 135° . The energy spectra of the scattered electrons were measured, and absolute cross sections were found by comparison with elastic scattering from the proton.

The target material was cooled compressed helium and hydrogen gas, and the detector was a single Čerenkov counter used with a double-focussing spectrometer.

Corrections were applied to the data for target density

variation, for contamination of the detected electrons by π^- mesons, and for electron radiation. An unfolding procedure was used for the latter.

The spectra appear in the form of broad peaks having widths varying from 60 Mev at small angles to 90 Mev at large angles. There is no conclusive evidence for structure in their shapes.

Within the validity of adapting to He^4 one of the results of the Goldberg impulse approximation theory for deuteron electrodisintegration, the cross sections at the maxima of these curves give a value of $M \langle 1/p \rangle_\alpha$ of (7.5 ± 1.5) , where M is a nucleon mass and $\langle 1/p \rangle_\alpha$ is the expectation value of the reciprocal of the momentum of a nucleon bound in He^4 .

The energy-integrated cross sections σ_α agree within experimental error with $\sigma_\alpha = 2(\sigma_p + \sigma_n)$, where σ_p is the free proton cross section and σ_n is the neutron cross section found from inelastic scattering from the deuteron; this equation represents nucleon ejection in the breakup process without interference from binding or meson exchange effects. At 400 Mev, 45° , σ_α is less than $2(\sigma_p + \sigma_n)$, but it is consistent with a 40 percent admixture of deuteron ejection.

Some elastic cross sections were also measured. Their absolute values are consistent with the results of Part I. Microfilm \$2.75; Xerox \$4.80. 95 pages.

ABSOLUTE MEASUREMENTS OF INTERNAL CONVERSION COEFFICIENTS FOR PURE E2 TRANSITIONS

(L. C. Card No. Mic 60-6147)

William Francis Frey, Ph.D.
Vanderbilt University, 1960

Supervisor: Professor J. H. Hamilton

Measurements have been carried out for the absolute determination of internal conversion coefficients for several transitions in the decays of scandium-46, cobalt-58, iridium-192, and gold 198. The method used for making these determinations was the "internal-external conversion method." With this method, the only data which were required were the measurements of internal conversion lines belonging to certain transitions and the corresponding external conversion or photoelectron lines obtained with a suitable converter. These measurements have been performed with the Vanderbilt iron-free, double-focusing, beta-ray spectrometer. The internal conversion coefficients can be calculated from such measurements with additional knowledge of spectrometer constants and photoelectric cross-sections. These calculations have been performed by the Swedish electronic computer BESK.

The primary purpose of these studies has been to further investigate certain "anomalies" which have recently been reported in internal conversion coefficients for unhindered, pure E2 transitions. Moreover, it has been of interest to determine if these discrepancies between experimental and theoretical conversion coefficients could be correlated with nuclear structure effects. In order to properly infer definite conclusions concerning the nuclear

structure effects, investigations have been carried out for a number of fast, pure E2, internal conversion coefficients in both the high and low atomic number region.

The sources used for these studies have all been obtained from the Oak Ridge National Laboratory. The scandium-46, cobalt-58, and iridium-192 sources were liquid deposited onto aluminum coated mylar ($\approx 980 \mu\text{g}/\text{cm}^2$). These sources were less than $150 \mu\text{g}/\text{cm}^2$. The gold-198 source (thickness $\approx 10 \mu\text{g}/\text{cm}^2$) was prepared by electrodeposition onto a silver foil ($\approx 2 \text{ mg}/\text{cm}^2$). All sources were covered with a zapon film ($\approx 10 \mu\text{g}/\text{cm}^2$) to protect them from flaking.

The gamma rays were converted into photoelectrons in a $2.19 \pm 0.02 \text{ mg}/\text{cm}^2$ rectangular uranium converter. The converter was mounted on a 0.8 mm thick aluminum disk which also stopped any electrons emitted by the source. The internal conversion line could be measured, and then without moving the source in the holder the converter could be inserted, and the external photoline could be measured. In all cases the detector was a continuous flow G-M counter.

The results of these investigations agree quite well with theoretical internal conversion coefficients for the measurements made at relatively low atomic numbers. However, at high atomic numbers the experimental values are ten to twenty per cent lower than theoretical values even for unhindered transitions. These discrepancies cannot be attributed to improperly assigned mixtures of multipolarity because, in general, the transitions investigated were of the pure E2 type. No admixtures occur in the $2+$ to $0+$ transitions. Therefore, these studies have indicated that the discrepancies shown between theory and experiment do have a dependence on the atomic number. Consequently, there may indeed be nuclear structure effects which have not yet been explained. In particular, finite nuclear size effects should show this dependence on atomic number.

The internal-external method of measuring internal conversion coefficients is free from many distortions which may occur in other methods. The principle uncertainty in the prior method is the photoelectric cross-section. At present, the accuracy of these cross-sections is at best five per cent. Hence the ultimate accuracy of this method is of that order.

The internal-external method depends strongly upon knowing the angular distribution of the photoelectric effect. However, the information available concerning such distributions is limited especially at low energy. For this reason, a complete longitudinal angular distribution of the photoelectric effect has been carried out at energies of 159 kev for the K, $L_1 + L_{11}$ and L_{111} shells and 208 kev for the K shell. These investigations were made by using a source of gold-199. These distributions will serve well to supplement the information already available concerning the photoelectric distributions at higher energies. The results of these angular studies have also been included in this report.

Microfilm \$2.75; Xerox \$5.40. 108 pages.

APPLICATION OF SPECTRUM ANALYSIS TECHNIQUES TO THE GAMMA RAY SCINTILLATION SPECTRA OF THORIUM B

(L. C. Card No. Mic 60-4312)

William Paul Ganley, Ph.D.
The University of Buffalo, 1960

An experimental investigation of the gamma radiations from Thorium B (Lead 212) is reported. Use is made of the recently developed response function technique for the analysis of total gamma ray spectra produced by scintillation counters, and the technique is further developed for the analysis of coincidence spectra.

The coincidence circuitry consists of a fast-slow coincidence system designed to give a resolving time of about 40 millimicroseconds for use with sodium iodide scintillation counters. A circuit of this resolving time produces essentially no chance counting rate with the source intensities that may be used without overloading the scintillation detector.

The remainder of the detection equipment consisted of four 1-3/4 by 2 inches sodium iodide crystals, preamplifiers, single channel analyzers and linear amplifiers, and three highly regulated 1800-volt power supplies.

Lead 212 was separated from its daughter products by means of a chemical separation procedure recently developed by several investigators.

The following gamma radiations have been observed: 115 Kev, 177 Kev, 239 Kev, 300 Kev, and 415 Kev, and are definitely attributed to Lead 212. The gamma cascades 177-239 and 115-300 Kev have been observed and are definitely attributed to Lead 212. The gamma rays 164 Kev and 250 Kev and the cascade 164-250 Kev have not been observed, and in accordance with recent electron conversion work, are assumed not to exist. In addition, the intensities of the following lines have been measured: 177 Kev, about 3×10^{-3} photons per decay; 239 Kev, $0.44 \pm 10\%$ photons per decay; 300 Kev, $0.034 \pm 10\%$ photons per decay; and 415 Kev, about 2×10^{-3} photons per decay. Finally, the K conversion coefficients have been measured for the 239 Kev line and the 115 Kev line to be $0.74 \pm 10\%$ and $5.8 \pm 15\%$ respectively, confirming the multipole order for these transitions which have been reported as magnetic dipoles.

Microfilm \$2.75; Xerox \$5.40. 108 pages.

PHOTONEUTRON THRESHOLDS

(L. C. Card No. Mic 60-3583)

Kenneth Norman Geller, Ph.D.
University of Pennsylvania, 1960

Supervisor: Professor J. Halpern

An improved energy control system for the 25 Mev Betatron has been designed and calibrated using thresholds for photoneutrons from deuterium, bismuth, copper and for the isochromat from the 15.12 Mev level in carbon. The energy scale, evaluated by a weighted least squares fit where both variables are subject to error, is linear with respect to electron momentum to 0.15% from 2 to

15 Mev. No satisfactory calibration standard has been found above 15 Mev, but the extrapolated calibration is apparently linear to 22 Mev as it gives satisfactory assignments for known energy levels in carbon and oxygen. The adjusted values for bismuth and copper thresholds are $7.432 \pm .010$ Mev and $10.833 \pm .016$ Mev, respectively.

A total of 73 photoneutron thresholds have been measured throughout the periodic table with an average accuracy of the order of 50 kev. Neutron yield data in the region of threshold is in most cases obtained by direct neutron detection using 3 BF₃ counters embedded in a paraffin moderator. In the region A 40, and where feasible for larger A, radioactivity detection methods using 2 NaI(Tl) crystals were used. The measured thresholds are compared with other results for the reaction Q-value obtained from mass data and reaction energies. In some instances the observed photoneutron threshold does not correspond to the neutron binding energy of the initial nucleus. The apparent threshold represents either (1) resonant photon absorption at an energy slightly greater than the kinematic threshold energy, or (2) neutron emission leaving the residual nucleus in an excited state having a more favorable spin. The first effect is particular to light nuclei with A 40; accordingly, discrepancies of this nature will be reflected in betatron energy scales using light nuclei as calibration standards. The second effect is particular to medium and heavy nuclei where the difference in spin between the initial and residual nuclei is 7/2. If the transition is to a known excited state in the residual, the neutron binding energy can be inferred from the threshold measurement. Otherwise, the measured threshold represents an upper limit to the neutron binding energy.

Microfilm \$2.75; Xerox \$9.25. 204 pages.

THE REACTIONS OF ALPHA PARTICLES WITH TIN-124

(L. C. Card No. Mic 61-251)

Richard Leonard Hahn, Ph.D.
Columbia University, 1960

The excitation functions for the (α, n), (α, p), ($\alpha, 3n$), (α, pn) and (α, an) reactions of Sn¹²⁴ have been determined with alpha particles from 15-40 Mev. Cross sections for the production of the isomers of Te¹²⁷, Sb¹²⁶ and Sn¹²³ are also presented. Reactions in which there is only neutron emission predominate: the maximum cross sections for (α, n) and ($\alpha, 3n$) (metastable state) are 0.178 barns at 18 Mev of excitation and 1.30 barns at 36 Mev, respectively. The (α, p) has its maximum of 0.019 barns at 28 Mev, while the (α, an) peak is 0.060 barns at 38 Mev. The results are discussed in terms of the statistical theory of nuclear reactions. A satisfactory fit to the (α, n) and (α, p) data is obtained for $r_0 = 1.7$ fermis and $a = 1.6$ Mev⁻¹. However, both excitation functions exhibit high energy tails not predicted by the theory. The shape and magnitude of the (α, an) excitation function obtained from evaporation theory are in agreement with the experimental results.

Microfilm \$2.75; Xerox \$3.00. 52 pages.

MEASUREMENT OF LOW ENERGY BETA-RAY SPECTRA USING A HIGH PRESSURE PROPORTIONAL COUNTER

(L. C. Card No. Mic 60-6988)

Robert Lloyd Hoover, Ph.D.
The University of North Carolina, 1960

Supervisor: P. E. Shearin

A large proportional counter suitable for measuring radioactive gases is described. The counter is capable of resolving line spectra below 200 ev. The cathode of the counter is made of wires to reduce background and is surrounded by a ring of 9 anti-coincidence counters which use the common cathode of the main counter. The anti-coincidence counters permit accurate measurements of ionizing events which take place completely within the volume of the main counter by rejecting events which originate in the main counter and end beyond the cathode, or those events which originate beyond the cathode and end within the counter volume. The main-counter anode is divided into a short and a long section to minimize end effects. The short section data are subtracted from the long section data. Results for the low energy spectrum of C^{14} and the electron-capture of A^{37} are presented.

Microfilm \$2.75; Xerox \$4.80. 94 pages.

DIFFERENTIAL CROSS SECTION FOR SCATTERING OF 189.6 MEV ELECTRONS THROUGH 60° BY HYDROGEN

(L. C. Card No. Mic 60-6741)

Robert Wallace McAllister, Ph.D.
Stanford University, 1960

A measurement of the differential cross section for electron scattering from hydrogen at laboratory energy and angle of 189.6 Mev and 60° is described. Such a determination is a logical extension of recent electron scattering experiments and is desirable from a number of standpoints. First, it removes an additional variable compared with experiments determining only an angular distribution. Second, because of the choice of experimental conditions, the result is not sensitive to the distribution of the anomalous part of the proton's magnetic moment and can therefore be employed to provide information about the distribution of the proton's charge alone. Finally, since the result depends on the Schwinger correction for radiative effects, it provides information about the validity of this correction. The problem, definition of the experimental conditions, and a resume of the theory applicable to the problem under these conditions is presented in Chapter 1.

The measurement was straightforward but involved a number of interesting experimental methods. Four quantities -- the number of incident electrons, the number of scattered electrons, the number of target protons per cm^2 , and the size of the experimental acceptance solid angle -- were measured, along with various parameters determining the prevailing experimental conditions. Chapter 2 conveys a general understanding of the whole experimental

apparatus and performance of the experiment without attempting to present small effects arising from the departure from the ideal case.

Chapter 3, on the other hand, describes in detail the apparatus for and performance of the above mentioned measurements. The incident beam was measured with a Faraday cup. The number of scattered electrons was determined essentially by using the area under the scattered energy distribution peak as a measure. This distribution was obtained by varying the incident energy, whose defining magnet was uniform and operated far below saturation, leaving undisturbed the scattered energy window of the spectrometer, which was non-uniform and operated near saturation. The incident energy defining magnet was calibrated with the floating wire method and monitored during the experiment, along with the spectrometer, by proton resonance. Electrons were detected with a Cerenkov counter, whose efficiency was investigated experimentally. The target (alternatively polyethylene and carbon) characteristics were determined by a density measurement and chemical analysis. Thin targets were used in order that radiation effects in the target be small. The experimental acceptance solid angle was shown to be geometrically defined. Corrections for small non-ideal effects are calculated.

Chapter 4 gives the counting run data taking procedures and presents the data in raw form. A description is given of the checks made during runs to ensure good data.

The interpretation of the data is given in the final chapter. The various corrections are numerically evaluated, and an error analysis is introduced. A value of the experimental cross section of $(1.238 \pm 0.055) \times 10^{-30} cm^2$ is found. The comparison of this value with the theory presented in Chapter 1 results essentially in determining whether or not the experimental cross section is consistent with the Schwinger correction and existing values of the RMS charge radius of the proton. If the calculated Schwinger correction of 0.844 is used, the comparison with experiment yields a value of $(0.71 \pm 0.12) \times 10^{-13} cm$ for the RMS charge radius. On the other hand, if the existing value of $(0.80 \pm 0.04) \times 10^{-13} cm$ for the RMS charge radius is used, the comparison yields an experimental value of the Schwinger correction of 0.871 ± 0.041 . Finally, a discussion of the problems involved in making a more precise determination of the experimental cross section is given.

Microfilm \$2.75; Xerox \$8.00. 173 pages.

SMALL ORDER SHAPE FACTORS IN BETA SPECTRA

(L. C. Card No. Mic 61-460)

Robert Ted Nichols, Ph.D.
Iowa State University of Science and Technology, 1960

Supervisor: Erling N. Jensen

The beta spectra of In^{114} , P^{32} , Y^{90} and Na^{22} have been studied closely in an intermediate-image beta-ray spectrometer and compared to theoretical predictions in terms of a linear shape factor of the form $(1+aW)$. The values obtained for a were $+0.0036 \pm 0.0021$ l/mc^2 for In^{114} , -0.0133 ± 0.0011 l/mc^2 for P^{32} , and -0.0047 ± 0.0008 l/mc^2

for Y^{90} , all for electron kinetic energies from about 200 kev up to near the maximum beta energies. A value for a of $+0.023 \pm 0.006$ l/mc² was obtained from Na^{22} over the energy range from 50 kev to 450 kev. Pm^{147} similarly analyzed in terms of the statistical shape had a shape-factor slope of -0.026 ± 0.015 l/mc² over the energy range from 50 kev to 200 kev. Tests were made to give indications for spectrometer fidelity. Because of the linearity of the shape-factor plots and the similarity in energy range, the comparative results from In^{114} , P^{32} and Y^{90} are taken as a definite indication that for at least two of these activities the shape-factors have non-zero slopes, irrespective of questions of instrumental fidelity.

Microfilm \$2.75; Xerox \$4.40. 85 pages.

**ABSOLUTE (n,2n), (n,p γ), AND (n, $\alpha\gamma$)
CROSS SECTIONS FOR 14.1-MEV NEUTRONS
ON ZIRCONIUM AND THE CALIBRATION OF
A CRYSTAL SCINTILLATION SPECTROMETER.***

(L. C. Card No. Mic 60-6236)

Clyde Howard Reed, Ph.D.
University of Utah, 1960

Chairman: Professor Thomas J. Parmley

Absolute (n,2n), (n,p γ) and (n, $\alpha\gamma$) cross sections have been measured for 14.-1 Mev neutrons incident on natural zirconium for the following specific reactions: $Zr^{90}(n,2n)-Zr^{89m}$ and $Zr^{90}(n,2n)Zr^{89}$; $Zr^{90}(n,p)Y^{90}$, $Zr^{91}(n,p)Y^{91m}$, $Zr^{91}(n,p)Y^{91}$, $Zr^{92}(n,p)Y^{92}$, and $Zr^{94}(n,p)Y^{94}$; $Zr^{90}(n,\alpha)-Sr^{87m}$, $Zr^{92}(n,\alpha)Sr^{89}$, and $Zr^{94}(n,\alpha)Sr^{91}$. In addition, upper-limit values were obtained for the cross sections of the reactions $Zr^{90}(n,\alpha)Sr^{83}$, $Zr^{94}(n,pn)Y^{93}$, and $Zr^{94}(n,d)Y^{93}$.

Neutron-induced activities of each irradiated zirconium sample were isolated by means of standard radiochemical procedures as separate zirconium, yttrium, and strontium fractions. Product nuclide activities were determined by the absolute counting of emitted beta and gamma radiation. A significant part of this work was devoted to the calibration of a NaI(Tl)-crystal scintillation spectrometer used to detect decay gamma radiation. Beta-gamma coincidence techniques were employed to standardize solutions of radioisotopes used in the crystal calibration procedure.

Theoretical (n,2n), (n,p γ), and (n, $\alpha\gamma$) cross sections were calculated on the basis of the statistical compound nucleus assumption. Particle-capture cross sections were derived from the "continuum theory" for a radius constant $r_0 = 1.4 \times 10^{-13}$ cm and an assumed square-well nuclear potential. These calculations were performed using the simple level density expression

$$\omega(E) = \text{const} \times \exp \left\{ 2 \left[(A/10.5)E \right]^{1/2} \right\}$$

for excited residual nuclei. Allowance was made for the relative displacement of even-A level densities by means of appropriate empirical factors.

For the (n,p γ) and (n, $\alpha\gamma$) reactions an order of magnitude discrepancy is observed between experimental cross sections and theoretical values obtained from the

statistical assumption. There is good agreement between theory and experiment for the (n,2n) reaction in Zr^{90} .

Other calculations based on the direct interaction theory of Brown and Muirhead yield cross section values for the (n,p γ) process that are in good agreement with experimental values. These results suggest the possibility that a direct-interaction mechanism is predominant in the (n,p γ) reaction for 14.1-Mev neutrons on the zirconium isotopes.

*Work performed under the auspices of the U. S. Atomic Energy Commission.

Microfilm \$3.20; Xerox \$11.25. 247 pages.

**NUCLEAR LEVEL DENSITIES
AND REACTION MECHANISMS FROM
INELASTIC NEUTRON SCATTERING**

(L. C. Card No. Mic 61-287)

David Browning Thomson, Ph.D.
University of Kansas, 1960

The continuous spectrum of fast neutrons scattered inelastically by each of twenty elements has been observed at an incident energy of 7.0 Mev. The elements range in mass number from 26 to 209. The neutron spectra were observed in the range of 0.5 to 4.0 Mev. These data made possible a measure of the systematic variation of nuclear level density with mass number at an average excitation energy of about 6.0 Mev. Similar observations were made for many of the same elements at one or more lower values of incident energy ranging from 4.0 to 6.0 Mev. These additional observations made possible a quantitative determination of the effect of reaction mechanisms on the observed spectra, and made possible a measurement of the variations of level density over a wider range of excitation energy.

Angular distributions of the continuous spectra of 5.0 Mev neutrons scattered inelastically by niobium and indium were measured. Similarly, angular distributions of the discrete spectrum of neutrons scattered inelastically due to excitation of the first excited state of Mg^{24} were observed at incident energies of 3.0, 4.0, and 5.0 Mev. These angular distributions provided additional information on the relative roles of various possible reaction mechanisms.

The results of the measurements are the following: (1) Compound nucleus formation is the predominant reaction mechanism but direct interaction plays a significant role. (2) The inferred variations of nuclear level density indicate that the nuclear entropy varies with the excitation energy either linearly, as the square root, or in some intermediate fashion, apparently depending on the shell structure of the nucleus in question. (3) The inferred variations of nuclear level density with mass number indicate that this quantity increases with mass number in the regions between closed shells but goes through significant minima near and at closed shells. (4) The effects of pairing energy are significant at the excitation energies studied. Microfilm \$2.75; Xerox \$7.40. 156 pages.

PHOTONUCLEAR MEASUREMENTS
WITH MONOENERGETIC GAMMA RAYS
FROM THERMAL NEUTRON CAPTURE

(L. C. Card No. Mic 61-74)

Robert Edward Welsh, Ph.D.
The Pennsylvania State University, 1960

The photonuclear reactions $Ta^{181}(\gamma, n) Ta^{180m}$ (8.15 hr), $Nb^{93}(\gamma, n) Nb^{92}$ (10 day), $Au^{197}(\gamma, n) Au^{196}$ (5.6 day), $Ho^{165}(\gamma, n) Ho^{164}$ (34 min) and $Ag^{107}(\gamma, n) Ag^{106}$ (24 min) have been studied with monoenergetic gamma rays. Various materials were placed in a thermal neutron flux and the photons resulting from neutron capture were employed as the gamma ray source for this study. Measurements were made in the energy range from 7.4 Mev to 10.8 Mev. By extrapolating cross section measurements to zero, threshold values or limits to the thresholds were obtained. Experimental uncertainties in the cross sections range from 25% to 50% and result mainly from uncertainties in the intensities of the neutron-capture gamma rays and in the decay schemes of the photon-induced isotopes. Good agreement has been obtained with previous measurements of these reactions performed with the continuous photon spectrum from electron bremsstrahlung. The threshold values or limits to the thresholds for the reactions listed above were 7.58 ± 0.05 Mev, 8.97 to 9.2 Mev, 7.91 to 8.4 Mev, 7.91 to 8.4 Mev, and 9.28 to 9.6 Mev respectively. The half life of Ho^{165} was measured as 33.6 ± 1 minutes.

Microfilm \$2.75; Xerox \$3.80. 67 pages.

BOSON CURRENTS IN THE THEORY OF
WEAK INTERACTIONS

(L. C. Card No. Mic 61-531)

William Bardwell Zeleny, Ph.D.
Syracuse University, 1960

A possible new method of introducing boson currents into the weak interaction is suggested. The Bose fields are assumed to obey the first order Kemmer equation. In this way, the boson and fermion currents enter the interaction in a symmetric manner. Three coupling constants are introduced according to the degree of isotopic spin and strangeness symmetries of the currents. The interaction so obtained gives rise in a natural way to the $|\Delta T| = \frac{1}{2}$ selection rule and its violation. It also gives rise to fast pionic modes and slow leptonic modes of hyperon decay.

First order calculations are performed for K_{e3}^+ and $K_{\mu 3}^+$ decays and the two modes of $K_{\pi 3}^+$ decay. Calculations of the decay rates yield sufficient information to determine the approximate magnitudes of the coupling constants. Calculations of branching ratios and energy spectra of decay particles are also performed and compared with experiment. With the exception of the Dalitz plot distribution of $K^+ \rightarrow \pi^+ + \pi^+ + \pi^-$ events, the theory fits the experimental data fairly well when account is taken of the first order approximations and the experimental errors.

Microfilm \$2.75; Xerox \$4.80. 91 pages.

PHYSICS, SOLID STATE

A NEUTRON DIFFRACTION STUDY
OF KRYPTON IN THE LIQUID STATE

(L. C. Card No. Mic 60-6789)

Glen Talmadge Clayton, Ph.D.
University of Missouri, 1960

Supervisor: Professor N. S. Gingrich

A study was made of the neutron diffraction patterns obtained from krypton in the liquid state under seventeen conditions of temperature and pressure between 117°K and 210°K. The diffraction patterns were obtained by use of one of the neutron diffractometers of the Metallurgy Division of the Argonne National Laboratory.

Neutrons of 1.05A wavelength were selected from a beam of neutrons from the CP-5 reactor by reflection from the (111) planes of a single copper crystal, and this nearly monochromatic beam was incident upon the sample. The patterns obtained at 117°K, 133°K, 153°K, 183°K, and 210°K were repeated at least three times to obtain more reliable patterns for making further analysis. These diffraction patterns are the first ever reported for liquid krypton and they show four well-defined prominences at the lower temperatures and three at the higher temperatures.

This program required the development of apparatus with unique characteristics which would permit the containment of the sample at elevated pressures. The krypton under study filled a volume of 0.660 inch diameter and 1.5 inch height in a cell fabricated from an aluminum single crystal grown especially for this research. This cell withstood pressures up to 55 atmospheres while contributing to the cell scattering of neutrons in an amount lower than ever reported by anyone for this kind of work. The cell was housed in an evacuated cryostat and kept at temperatures ranging from 117°K to 210°K at values constant to within 0.05°K by electronic controlling circuits, and the original charge was contained in a closed system for the duration of the experiment. After appropriately correcting the diffraction patterns for effects of background scattering, incoherent scattering, and empty cell scattering, these intensity data were Fourier transformed to give the atomic radial distribution function at each of the temperatures. These calculations were performed by use of the computer GEORGE of the Argonne National Laboratory. The speed of this computer made it feasible to investigate the sensitivity of the resultant distribution functions to arbitrary adjustments in the input data. Studies were made of the effect on the distribution of (1) terminating the calculation at arbitrary points, (2) using different values of incoherent scattering correction, (3) using different estimates of independent scattering, and (4) modifying the data by arbitrary exponential factors.

Atomic distributions at all temperatures showed non-discrete first peaks indicating that no molecule is formed. For the five temperatures at which the liquid was carefully studied the positions of the first peaks and the number of nearest neighbors to which the first peak areas correspond are as follows: 117°K, 4.02A, 8.4 atoms; 133°K, 4.03A, 7.9 atoms; 153°K, 4.08A, 7.0 atoms; 183°K, 4.10A,

6.4 atoms; 210°K, 4.20A, 4 atoms. The number of nearest neighbors was found to be closely proportional to the density of the liquid.

By use of the series of distribution functions calculated from arbitrarily terminated data it was shown that the width of the potential bowl of liquid krypton is in approximate quantitative agreement with that of the Leonard-Jones potential. This series of patterns also indicate that some relevant information remains unobserved beyond the range of experimental observation.

Microfilm \$2.75; Xerox \$6.60. 136 pages.

FREQUENCY SPECTRA OF LATTICES WHOSE PARTICLES INTERACT WITH LONG RANGE FORCES

(L. C. Card No. Mic 61-414)

John Alan Davies, Ph.D.
University of Maryland, 1960

Supervisor: Dr. A. A. Maradudin

In this thesis the properties of the normal mode frequency spectra of lattices in which long range interactions exist between the lattice particles are studied for two- and three-dimensional crystal models. The models to be studied are, firstly, two-dimensional square lattices with either transverse vibrations normal to the plane of the lattice, or with longitudinal vibrations in the plane of the lattice. Secondly, a special three-dimensional simple cubic lattice is treated. The types of interactions assumed to exist between lattice particles are pair potentials varying as inverse powers of the distance between the interacting particles. It is found that long range interactions give rise to types of singularities in the frequency spectrum and its derivatives which do not occur when only short range interactions exist in the lattice. The general nature of these new types of singularities is studied, and several specific examples are given. In addition, in the introduction a treatment of lattice models having only short range interactions between constituent particles is given for purposes of comparison with the long range potential models.

Microfilm \$2.75; Xerox \$8.80. 192 pages.

EXCITATION OF CARRIERS FROM IMPERFECTIONS IN DIAMOND

(L. C. Card No. Mic 61-445)

Jarl Avarð Elmgren, Ph.D.
Iowa State University of Science and Technology, 1960

Supervisor: Donald E. Hudson

Charge carrier traps have a marked effect on the electrical conduction properties of diamond, as observed in photoconductivity and nuclear particle counting experiments. This investigation was undertaken to determine the optical energies required to liberate the trapped charges.

To attain this goal, the author studied the effect of a known flux of monochromatic light on the decay of a persistent internal field. This field was generated by the spatial displacement of trapped holes from trapped electrons. The counting rate of the polarized diamond acting as a nuclear particle conduction counter was used as a probe of the internal field during the experiment.

The internal field decayed exponentially with time under the influence of the light; the process was characterized by an intensity-dependent decay constant. The decay constants, normalized to a common photon flux varied over more than four orders of magnitude in the photon energy range from 1.8 ev to 3.5 ev. This variation was similar for both diamonds studied.

Two interpretations of the experiment have been proposed. The first, known as the trapping model, assumes that the photons liberate the trapped charges. A simple theory based on this model predicts that the cross-section for the liberation of a trapped charge is directly related to the photon-induced decay constant. The cross-sections estimated from the data vary from about 10^{-19} cm² at 1.8 ev to about 10^{-14} cm² at 3.5 ev. The large cross-sections at the high photon energies may be manifestations of a physically large imperfection. The second interpretation is based on the phenomenon of impurity photoconduction with an internal field. The decay mechanism in this interpretation is the neutralization of trapped charges by charges liberated from normally filled imperfection levels by the photons. On the basis of this interpretation, the experimental graph of decay constant versus photon energy displays the spectral photoconductive response in the imperfection level region. Although a choice cannot be made on the basis of any experimental data obtained, the photoconductivity model appears to be the more defensible model.

An important further conclusion can be drawn from the measurement of the internal field decay in the dark. The very slow dark decay observed in this work suggests that the resistivity of diamond is perhaps 10^2 to 10^3 times greater than the normally accepted values at 25°C. The present experiment tended to measure the bulk resistivity with minimal interference from surface effects.

Microfilm \$3.15; Xerox \$11.05. 242 pages.

A RUBY MASER RADIOMETER, AND THE MEASUREMENT OF CENTIMETER WAVE RADIATION FROM VENUS, MARS, AND JUPITER.

(L. C. Card No. Mic 60-5828)

Joseph Anthony Giordmaine, Ph.D.
Columbia University, 1960

Radiation at 3 cm. wavelength associated with the planets Venus, Mars, and Jupiter has been measured with the use of a maser type radiometer in conjunction with the U. S. Naval Research Laboratory 50 ft. reflector. The fluxes of radiation correspond to apparent planetary temperatures of 575°K., 211°K., and 177°K. respectively. The apparent temperature is defined as the temperature of a black body subtending the same solid angle as the planetary disc, which produces the observed flux.

The radiation associated with Venus, indicating an unexpectedly high temperature, was found to have the same intensity 80 days after conjunction as had been measured at conjunction in 1956. Since the illumination of the disc varies from 0 to 50 percent during this period, the apparent temperature of the dark side of the planet appears to be approximately the same as that of the illuminated side. The radiation is interpreted as thermal radiation from below the cloud surface and possibly from the solid surface. The apparent temperature of Mars at opposition is somewhat less than the infrared temperature. The radiation is interpreted as thermal radiation from a sub-surface layer.

The Jupiter radiation was observed over a period of nine months. The average temperature during this period appeared to be significantly higher than that measured with the same antenna in 1957. There was evidence of a fluctuation in apparent temperature at the beginning of the 1958 recurrence of activity in the South Equatorial Belt. The variation of apparent temperature with frequency was $(-1.2 \pm 1.1) \times 10^{-2} \text{ }^\circ\text{K/mc.}$ based on observations over a ten percent frequency range. No conclusive correlation was observed between fluctuations in the apparent temperature and planetary rotation, nor between the temperature fluctuations and solar activity. No evidence was found for any appreciable component of linear polarization in the Jupiter radiation.

The expected apparent temperature of Jupiter at centimeter wavelengths is calculated on the basis of two different model atmospheres, on the assumption that the radiation is thermal emission from gaseous ammonia. The calculated temperatures are in good agreement with the observed temperature at 3 cm. wavelength, but fall short of the measured temperatures at longer wavelength. The radiation at 3 cm. wavelength is interpreted as thermal radiation from the atmosphere.

The radiometer used in this work had as a preamplifier a maser device of the three-level type proposed by Basov and Prokhorov and by Bloembergen. The energy levels utilized were those of the paramagnetic Cr^{+3} impurity in ruby. At liquid helium temperature in a magnetic field of a few thousand oersteds, four energy levels with spacings of the order of 0.5 cm^{-1} are accessible. By saturating the first and third levels with microwave power at 1.3 cm wavelength, the population of the third level was maintained at a higher value than that of the second level, and amplification by stimulated emission was obtained at 3 cm wavelength, corresponding to the energy difference between the second and third levels.

The over-all input noise temperature of the radiometer was 85°K. , including contributions from antenna spillover and from atmospheric radiation. This noise level represents an enhancement in sensitivity of about 12 over a comparable superheterodyne radiometer. With a 5.5 mc. bandwidth and a 5 sec. time constant, the residual rms noise in the radiometer was 0.04°K. in units of antenna temperature.

In this thesis, the theory of maser amplification and noise is applied to the maser preamplifier. The observed gain in sensitivity is found to be in good agreement with theory. Microfilm \$2.75; Xerox \$9.45. 208 pages.

EFFECT OF RADIATION ON THE ELECTRICAL CONDUCTIVITY IN BISMUTH

(L. C. Card No. Mic 61-448)

Donald Duane Glower, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Glenn Murphy

The analysis described in this thesis makes it possible to correlate the theory of irradiation damage with experimental data. The generally accepted manner of reporting integrated flux (in nvt) must be supplemented with additional information before comparison of experimental data can be made. The additional factors must indicate flux spectra, temperature, and, in the case of polycrystalline specimens, average crystal size.

An irradiation experiment was performed on three bismuth specimens, one polycrystalline of a known uniform crystal size, one single crystal with conduction parallel to the c axis, and one single crystal with conduction perpendicular to the c axis.

The data from this experiment revealed that equilibrium between the production rate for radiation damage and the annealing rate can be reached during irradiation. Annealing curves were recorded for different temperatures and were analyzed by determining the decay rate of the individual processes. Two annealing processes were found, and were assumed to be interstitial atom and vacant lattice site annealing. This approach allowed determination of the effect of each process on the electrical resistivity during the production-annealing equilibrium period while under irradiation. The annealing activation energy was evaluated as 1 ev for interstitials and 1.46 ev for vacancies. The data also revealed that the polycrystalline specimen had a much higher rate of annealing than either of the single crystals indicating the possibility that annealing was facilitated by the grain boundaries.

Microfilm \$2.75; Xerox \$4.40. 84 pages.

SEEBECK EFFECT IN MAGNESIUM SILICIDE

(L. C. Card No. Mic 61-449)

Marvin William Heller, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Gordon C. Danielson

Single crystals of the semiconducting compound Mg_2Si were prepared from stoichiometric proportions of magnesium and silicon in graphite crucibles. Undoped crystals were n-type with carrier concentrations in the saturation region as low as $3 \times 10^{16} \text{ cm}^{-3}$; crystals doped with silver were p-type with saturated carrier concentrations of $2 \times 10^{18} \text{ cm}^{-3}$.

Apparatus are described for the measurement of the Seebeck coefficient (thermoelectric power), Hall coefficient, and electrical resistivity in the ranges 4°K to 300°K and 300°K to 1000°K .

At low temperatures the magnitude of the Seebeck coefficient of both n-type and p-type Mg_2Si exhibited a pronounced maximum; for the purest n-type samples the Seebeck coefficient increased from $800 \mu\text{V}/\text{deg}$ at 80°K to $3200 \mu\text{V}/\text{deg}$ at 25°K , then decreased at lower temperatures. This maximum is interpreted in terms of the phonon drag effect. The Seebeck coefficient, S , was the sum of two terms: the usual electron diffusion term, S_e , and the phonon contribution, S_p , resulting from the drag on the charge carriers exerted by phonons. At temperatures above 200°K , S_p was negligible and the effective mass parameter could be determined from the measured Hall and Seebeck coefficients if a scattering mechanism could be assumed. Below 200°K with this effective mass, the assumed scattering mechanism, and the measured Hall coefficient, the value of S_e was calculated and subtracted from the measured Seebeck coefficient to obtain S_p .

The resulting phonon Seebeck coefficients for Mg_2Si were compared with the theory of C. Herring (Phys. Rev. **96** 1163 (1954)). Herring's theory predicts that for an ideal semiconductor the magnitude of S_p should be proportional to $T^{-3.5}$. For the purer n-type Mg_2Si samples $|S_p|$ was proportional to T^{-3} from 30°K to 150°K . At temperatures below 20°K the scattering of phonons by the sample boundaries tended to restore the phonon distribution to equilibrium and consequently diminished $|S_p|$. In the boundary scattering range the magnitude of S_p was found to be proportional to the sample thickness. The increased carrier concentration of a factor of 100 in the p-type samples and one aluminum doped n-type sample resulted in a large reduction in $|S_p|$. Both of these latter two observations, the size effect and saturation effect, are in agreement with Herring's theory.

The purer n-type samples exhibited intrinsic behavior from 600°K to 1000°K . In this temperature range $S_e = S_{\text{meas}}$ was proportional to $1/T$: the slope of S vs $1/T$ implied that the ratio of electron to hole mobility was about 3.5. Intrinsic Hall and Seebeck coefficient results also gave values for the effective mass parameter ($m_n = 0.4 m_0$ and $m_p = 2 m_0$). The resulting values are in agreement with the mass parameters determined from the calculation of S_e in the extrinsic range if optical mode scattering predominated in the purer n-type samples and optical-mode scattering was comparable with ionized impurity scattering at 300°K for the p-type samples.

Microfilm \$2.75; Xerox \$5.80. 116 pages.

NUCLEAR MAGNETIC RELAXATION IN IONIC CRYSTALS

(L. C. Card No. Mic 60-6628)

Prem Prasad Mahendroo, Ph.D.
The University of Texas, 1960

Supervisor: Professor A. W. Nolle

The nuclear magnetic spin-lattice relaxation time, T_1 , of the quadrupolar nucleus Na^{23} and the non-quadrupolar nucleus F^{19} in high purity optical quality single crystals of NaCl , NaF , LiF , and BaF_2 has been measured over a temperature range from 77°K to 1000°K . A magnetic

recovery method is used, the magnetization being indicated by the free induction signal following a "90° pulse."

The data on the quadrupolar nucleus Na^{23} in two different samples, NaCl and NaF , indicates that Van Kranendonk's theory¹ of quadrupolar relaxation based on acoustical modes of lattice vibration and a perfect ionic model does not explain the magnitude of T_1 . Even on taking into account the relaxation due to the optical modes² of lattice vibration, there is a discrepancy by a factor of 2.5 between the observed and the theoretical values. The covalency³ is found to be ineffective in producing relaxation, but in view of the inaccurate knowledge of the wave functions the charge overlap⁴ of the neighboring ions is not ruled out as a source of major contribution to T_1 .

The temperature dependence of T_1 in the case of Na^{23} ions (as distinguished from the absolute values) indicates that in the appropriate temperature ranges, Van Kranendonk's two phonon "Raman process" is the effective relaxation mechanism, notwithstanding the uncertainty as to the details of the spin-lattice coupling mentioned above. At higher temperatures, the nature of the deviations from $1/T^2$ dependence of T_1 suggests that the relaxation due to the diffusion of Schottky defects becomes important.

Below 593°K , the observed values of T_1 of F^{19} ions in each of the three crystals of NaF , LiF , and BaF_2 are ascribed to the paramagnetic impurity relaxation. At higher temperatures the limiting rate process in the case of NaF is thought to be the diffusion of impurity (which may be present even in a 'pure crystal') generated vacancies, on the basis of the experimental value of the energy of activation, which is 0.65 electron volts (e.v.). On the other hand the diffusion of the thermally generated negative ion vacancies seems to be the important relaxation mechanism for F^{19} ions in BaF_2 crystal. The slope of the temperature versus T_1 curve in this case gives 0.82 e.v. as the energy of activation.

Extraordinarily large values of T_1 are found in the LiF crystal (3600 sec. at room temperature). Waller's mechanism⁵ does not explain the results and in the temperature range of our measurements (350° to 700°K) on this sample, the relaxation is ascribed to paramagnetic impurities.

1. J. Van Kranendonk, *Physica* **20**, 781 (1954).
 2. Wikner, Blumberg and Hahn, *Phys. Rev.* **118**, 631 (1960).
 3. K. Yoshida and T. Moriya, *J. Phys. Soc. (Japan)* **11**, 33 (1956).
 4. J. Kondo and J. Yamashita, *Phys. Chem. Solids* **10**, 245 (1959).
 5. I. Waller, *Z. Phys.* **79**, 370 (1932).
- Microfilm \$2.75; Xerox \$5.60. 114 pages.

USE OF METAL ALLOYS FOR ADIABATIC DEMAGNETIZATION

(L. C. Card No. Mic 61-459)

David Torrison Nelson, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Sam Legvold

The magnetic susceptibility of some dilute alloys of rare earth metals in yttrium and ytterbium has been measured for temperatures below 4.2 °K. Alloys of gadolinium in yttrium showed a maximum in the susceptibility characteristic of an antiferromagnetic transition at 3.4 °K for 1 percent gadolinium and probably near 0.8 °K for 0.3 percent gadolinium. A similar anomaly was observed at 1.34 °K for 1 percent dysprosium in yttrium. Alloys of holmium in yttrium of 0.6 and 1.0 percent holmium showed no such anomaly down to 1.25 °K and 0.15 °K, respectively. An alloy of 1.25 percent holmium in ytterbium was only weakly paramagnetic down to 1.25 °K whereas an 0.4 percent europium in ytterbium alloy was apparently ferromagnetic at 4.2 °K.

Magnetization measurements on single crystals of 0.6 percent and 1.0 percent holmium in yttrium alloys were made in the temperature range 1.47 °K to 4.20 °K and in magnetic fields up to 11 koe. Anisotropy was observed with the magnetization in the direction of the a-axis being more than 5 times that in the direction of the c-axis. The extrapolated saturation magnetizations in the a-direction were 2.9 and 4.8 emu/g for the 0.6 and 1.0 percent alloys, respectively, compared with 3.8 and 6.3 emu/g, respectively, expected for ideal paramagnetic behavior.

Adiabatic demagnetizations were performed on the 0.3 percent gadolinium-yttrium alloy and the single crystals of 0.6 and 1.0 percent holmium in yttrium alloy from a field of about 11 koe at 1.25 °K. The lowest temperatures achieved were 0.83 °K, 0.81 °K, and 0.76 °K, respectively. Entropy calculations based on the magnetization measurements of the single crystals indicate that the entropy extracted during magnetization is only about 15 percent of that expected from an ideal paramagnetic. The conclusion is drawn that there are rather large magnetic interactions between solute ions at temperatures as high as 1.25 °K even though susceptibility measurements would not indicate this.

Microfilm \$2.75; Xerox \$5.20. 102 pages.

MICROWAVE MEASUREMENTS OF HALL MOBILITIES IN SEMICONDUCTORS

(L. C. Card No. Mic 61-461)

Yuichiro Nishina, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Dr. G. C. Danielson

The Hall mobilities of germanium single crystals were measured with a microwave frequency of 9000 Mc/sec over the temperature range 30°K to 300°K. A rectangular sample occupied the central part of a wall of a rectangular

cavity, which was doubly degenerate in the TE₁₀₁ mode and in the TE₀₁₁ mode at a single resonance microwave frequency. The external magnetic field and the microwave field associated with one of the two modes gave rise to the other mode of oscillation, owing to excitation by the microwave Hall field. The theoretical analysis was verified by measurements on an n-type sample having a room temperature resistivity of 0.40 ohm cm. The measured Hall mobility at microwave frequencies (with a size correction) was compared with the D. C. Hall mobility between 30°K and 300°K. The maximum discrepancy was 15%. The estimated experimental error in the microwave measurement was 16%. The magnetic field dependence of the microwave Hall mobility in a p-type sample, having a room temperature resistivity of 0.77 ohm cm, was in qualitative agreement with the D. C. results obtained by Willardson et al.

Microfilm \$2.75; Xerox \$5.20. 103 pages.

MEASUREMENT OF THE MEAN SQUARE VIBRATION AMPLITUDES OF ATOMS IN METALS BY X-RAY TECHNIQUES

(L. C. Card No. Mic 61-470)

Earle Richard Ryba, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Doctor Premo Chiotti

The intensities of x-ray reflections from large single crystals of copper and zinc have been measured as a function of temperature. The (400) reflection for copper and the (0006) and (2110) reflections for zinc were examined from 13°C to the melting point of each metal. The data were scaled by calculating a mean square vibration amplitude at the base temperature from the Debye-Waller theory. The functions $\mu_{hkl}^2(T)$ were then calculated for the atomic vibrations parallel to the a axis for copper and parallel to the c and a axes for zinc.

The logarithm of the intensities were plotted against a reduced temperature defined as:

$$T' = \frac{V(T)}{V(T_0)} T.$$

The Debye-Waller theory as modified by the above relation predicts that such a plot will be linear. For copper this plot was linear, and the modified Debye-Waller theory adequately explains the decrease with temperature of the reflection intensity. For zinc the plots were not linear, and thus the modified Debye-Waller theory cannot be applied to this anisotropic metal.

The mean square vibration amplitudes obtained were compared to the electrical resistivities of the polycrystalline metals. The theory of electrical resistivity indicates that the resistivity is directly proportional to the mean square vibration amplitude. For copper this proportionality was confirmed for the temperature range 200° to 1000°C, but no correlation was found for zinc.

Difficulty was experienced in obtaining reproducible intensity measurements. Some evidence is presented which indicates that this difficulty is due to changes in the mosaic structure of the single crystals during thermal cycling.

Microfilm \$2.75; Xerox \$4.60. 87 pages.

SOME PROPERTIES OF β MERCURY

(L. C. Card No. Mic 61-473)

James Emmanuel Schirber, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: C. A. Swenson

β -Hg is a stress induced phase of mercury which is the stable modification below 79°K. The crystal structure of β -Hg was determined in a low temperature X-ray cryostat designed for obtaining Debye-Scherrer powder pictures at liquid bath temperatures. Whereas ordinary (α -Hg) crystallizes in a rhombohedral lattice, β -Hg was found to be body-centered tetragonal ($c = 2.825$ A, $a = 3.995$ A). The observed characteristics for the transition from α to β -Hg could best be interpreted as martensitic (diffusionless). The resistance ratio between polycrystalline α and β -Hg was determined as a function of temperature from 4.2°K to the zero pressure β to α transition at 93°K.

The critical fields of both mercuries as a function of

temperature and pressure were measured. These measurements gave H_0 equal to 411 ± 1 and 340 ± 1 gauss and T_c equal to $4.153 \pm .001$ and $3.949 \pm .001$ °K for α and β -Hg, respectively. Both phases deviated from parabolic critical field behavior in the opposite direction to that observed for all other superconductors except Pb.

Mercury is the only known example of an element existing in two modifications both of which are soft superconductors, and so offers an opportunity to check the effect of structure on H_0 , T_c and γ , the coefficient of the electronic contribution to the normal specific heat. Only T_c seemed insensitive to crystal structure.

A knowledge of the critical field as a function of pressure and temperature permits calculation of thermodynamic quantities such as the electronic contributions to the specific heat and thermal expansion of the normal and superconducting states which are very difficult to obtain in any other way. These calculations were made and the electronic thermal expansion in the superconducting state was found to be negative for both phases.

Microfilm \$2.75; Xerox \$4.60. 90 pages.

PHYSIOLOGY

STUDIES ON LINES OF CHICKENS WITH DIFFERENT SERUM CHOLESTEROL LEVELS

(L. C. Card No. Mic 61-416)

Lester Babbitt Hardy, Jr., Ph.D.

University of Maryland, 1960

Supervisor: Dr. F. H. Wilcox

The experiments reported in this thesis were designed to elucidate the factors involved in the physiological control of serum cholesterol in two lines of White Leghorn chickens bred for differences in their serum cholesterol levels. Essentially three different approaches were used: 1) the effects of fasting on serum cholesterol, 2) the relationship of various hormones to serum cholesterol, and 3) the relationship between weight or cholesterol concentration of various organs and serum cholesterol levels.

The data repeatedly indicated that the male serum cholesterol was significantly higher than that of the female chicks of the high and low cholesterol lines.

Chicks of the high cholesterol line were fasted for 6, 14, 24, 48, and 72 hours. It was found that at each fasting duration, the serum cholesterol levels differed significantly from each other in a progressively increasing manner, with the exception of 6 and 14 hours of fast. A 24 hour fasting time was used to determine the effect of the removal of exogenous cholesterol on serum cholesterol levels of males and females of the two lines. Fasting for 24 hours significantly increased the serum cholesterol levels; however, it appeared to exert no influence on the significant difference between the lines.

To test the effects of exercise on serum cholesterol, battery reared birds were compared to chicks raised in a floor pen with over 8.5 times as much floor space. The

results show that the type of increased physical activity employed caused a significant depression of the serum cholesterol level of all birds; however, the line difference was not affected by this decreased level.

The effects of hormones on the serum cholesterol levels of the two lines were tested by injecting cortisone acetate, DL-thyroxine, testosterone propionate, diethylstilbesterol and estradiol benzoate. With the exception of estradiol benzoate, none of the injected hormones elicited a significant effect on the serum cholesterol between the two lines. Estradiol markedly increased the serum cholesterol of females of both lines; however, no statistically significant difference between lines was seen in this case due to the significant interaction between lines and treatments.

Hematocrit, growth rate, and feed conversion data were obtained for untreated controls of both lines and for birds exposed to fasting and hormone injections. The results indicate that no relationship of percent cell volume, growth rate, or feed conversion to serum cholesterol could be adjudged.

Organ weights were determined for males and females of both lines reared under normal conditions. The lines exhibited small, if any, differences among organ weights. When the cholesterol concentration of the testis, brain, adrenal, and liver were determined, it was found that there were no significant differences between the two lines in the cholesterol concentration of these organs.

The results obtained from these experiments suggest that the serum cholesterol difference between lines is not due to exogenous factors such as dietary intake of cholesterol or cholesterol precursors, or physical activity as employed in these trials. Of the endogenous factors examined, response to hormone injections, organ weight and organ cholesterol concentration were found not to be

involved in the difference of serum cholesterol between the high and low cholesterol lines.

Microfilm \$2.75; Xerox \$3.00. 56 pages.

THE CARBOHYDRATE METABOLISM OF CHICKEN SEMEN

(L. C. Card No. Mic 61-419)

Grover Cleveland Harris, Jr., Ph.D.
University of Maryland, 1960

Supervisor: Dr. Frank H. Wilcox

Studies were conducted to obtain basic information on the effects of dilution, carbohydrate concentration, incubation time and conditions, and the addition of various carbohydrates to chicken semen. Pooled samples of semen were collected from males of a flightless strain of chickens and immediately diluted at room temperature with an isotonic carbohydrate solution (1/3M) which was combined with a phosphate buffer (pH 7.2) in the necessary amounts to give the desired concentration. In the pH studies an isotonic NaCl solution (9.9 g/l) was substituted for the buffer. Three measures of metabolic activity were used: (1) Change in hydrogen ion concentration (pH) at 29° C.; (2) carbohydrate disappearance at 41° C.; and (3) lactic acid production at 41° C.

Dilution studies showed that as dilution was increased from 9 to 10 to 1 to 10, less decrease in pH occurred. A dilution of 1 to 4 which gave a rapid pH decline was used in all metabolism experiments.

The carbohydrate disappearance was greatest during the first hour of incubation, substantially reduced the second hour and extremely low during the third and fourth hour. Therefore, the one hour incubation period was considered optimum.

An increase in carbohydrate concentration resulted in a similar increase in disappearance if expressed on a milligram basis, but on a percentage basis an optimum could be established. The optimum concentration of fructose, as measured by pH decline and per cent disappearance, was approximately 11.1 mM/ml. At higher concentrations a depressing effect was shown.

The pH decline upon addition of 19 different carbohydrates to whole semen indicated that only fructose, glucose, mannose and to a slight extent maltose were utilized. The utilization of these carbohydrates was later confirmed in lactic acid production and disappearance studies. The disappearance studies also showed that the pentoses and other disaccharides were utilized.

The utilization of fructose and glucose was primarily by the sperm themselves. The pH decline after addition of fructose was quite rapid in washed sperm, but in the seminal plasma a rise in pH was noted although in later studies some lactic acid was produced with both fructose and glucose. Ribose was not utilized by washed sperm since it only produced lactic acid in the seminal plasma and whole semen. The utilization of ribose appeared to be by the non-cellular constituents of the seminal plasma since a reduction in bacterial count did not influence disappearance or lactic acid production.

The production of lactic acid by the added hexoses

demonstrated that chicken sperm have an active Meyerhof-Embden pathway for glycolysis. Alternate pathways may also be functioning since the amount of lactic acid produced did not account for all of the sugar which disappeared.

In incubation studies it was found that the metabolic activity under semi-anaerobic conditions was only slightly below that obtained under anaerobic conditions.

The addition of fructose 1,6-diphosphate and fructose-6-phosphate resulted in the production of small amounts of lactic acid. Phosphoglyceric acid was not utilized and did not produce any lactic acid.

Microfilm \$2.75; Xerox \$3.00. 58 pages.

STUDIES ON THROMBOPOIESIS: PART I. EFFECTS OF THROMBOPHERESIS, OPERATIVE TRAUMA, STRESS, DRUGS, ANAESTHETICS, ENDOCRINE AND HUMORAL SECRETIONS, AND SPLENECTOMY UPON THROMBOPOIESIS. PART II. IN VIVO TRANSFER OF A THROMBOPOIETIC FACTOR.

(L. C. Card No. Mic 61-408)

Bertram Spector, Ph.D.
Cornell University Medical College, 1961

This study on thrombopoiesis has a threefold objective:

1. To investigate some factors influencing thrombopoiesis.
2. To develop a model of thrombocytoregulation.
3. To provide conclusive evidence of a thrombopoietic substance, thrombopoietin, in the blood plasma of acutely thrombocytopenic rabbits.

These objectives were realized in two stages. Therefore, the thesis has been divided into two parts:

Part I examines the effects of thrombopheresis, operative trauma, stress, drugs, anaesthetics, endocrine secretions, humoral agents and splenectomy upon thrombopoiesis in the rabbit. These variables are not selected haphazardly, but form a rational pattern leading to the critical sections of Part II.

Part II provides evidence for thrombopoietin in the blood plasma of thrombocytopenic rabbits by the IN VIVO transfer of this thrombopoietic factor. Also developed in Part II is a scheme of thrombocytoregulation, and the relationship between the results of the present study and this scheme.

The experimental sections of Part I provided the following information:

Average daily platelet variations of nine untreated rabbits in the course of seven days deviated less than 5% from initial average counts. The standard deviation on any day never exceeded 18%.

Thrombopheresis and arteriotomy caused an initial thrombocytopenia which persisted for one day and was followed by thrombocytosis on the third or fourth day. Peak platelet counts were $2\frac{1}{2}$ to $3\frac{1}{2}$ times greater than control counts.

Controls for thrombopheresis were devised to evaluate

the effects of operative trauma upon thrombopoiesis. They were conducted by bleeding and reinfusing the same blood (using ether and Nembutal, or Nembutal alone as anaesthetics) as well as by femoral artery ligation without bleeding. Following each procedure, thrombocytosis was evident within three to four days. Ether alone was found to stimulate thrombopoiesis in some animals, whereas Nembutal generally had a slight depressing effect on platelet counts.

Intravenous injection of histamine did not usually influence thrombopoietic activity, but adrenaline and ACTH injected intravenously resulted in thrombocytosis within four days. However, not all animals responded to these agents, and those that did respond did not attain as pronounced thrombocytosis as in previous procedures.

Removal of the spleen, long considered to influence platelet levels in man by either emitting an inhibitory substance, or destroying platelets of subnormal viability had no permanent effect upon platelet levels in the rabbit. A transient thrombocytosis which developed within four days was attributed to operative trauma.

The complication of stress attending thrombopheresis, arteriotomy and other procedures performed upon an animal is not amenable to quantitative analysis and renders interpretation of the effects of such procedures inconclusive. Therefore it was considered that demonstration of a circulating thrombopoietic blood factor would best be accomplished by transfer of such factor to unstressed recipients and demonstration of thrombopoietic activity in these recipients.

Rabbits were made thrombocytopenic by injection of Myleran subcutaneously or anti-platelet serum intravenously. It was anticipated that the thrombocytopenia might act as a stimulus to increase the concentration of a thrombopoietic factor. Accordingly, in the experimental section of Part II, plasma from these acutely thrombocytopenic donors was transferred by intravenous injection to fifteen normal unanaesthetized recipients. Marked thrombocytosis followed such transfer. Group averages of $139\% \pm S.D.$ 28% of control platelet counts on the second day, $155\% \pm S.D.$ 40% on the third day, $166\% \pm S.D.$ 44% on the fourth day, and $144\% \pm S.D.$ 33% on the fifth day were obtained. Tests of significance of this group compared to an uninjected control group and a group injected with normal plasma yield a probability of $p < 0.001$ of chance occurrence. Intravenous transfer of plasma from normal donors to normal unanaesthetized recipients resulted in a significant depression of platelet levels within three days ($0.05 > p > 0.02$).

Splenectomized rabbits exhibited the same response as normal animals to plasma transfer from either normal or thrombocytopenic donors. This confirms the impression that the spleen plays a minor role in thrombopoiesis in the rabbit.

Reasonable evidence is offered for a proposed model of thrombocyto-regulation developed in Part II. The circulating thrombopoietic factor and circulating inhibitory factor demonstrated in the experimental program are consistent with the model and are believed by the author to be of prime importance in thrombocyto-regulation.

Microfilm \$2.75; Xerox \$7.60. 162 pages.

A DEVELOPMENTAL STUDY OF THE BOUND AND FREE GLYCOGEN FRACTIONS IN THE HEART AND LIVER OF THE MOUSE, AND THEIR DIURNAL VARIATIONS.

(L. C. Card No. Mic 60-6826)

Edgar Randolph Thomas, Ph.D.
University of Missouri, 1960

Supervisor: Dallas K. Meyer

Analyses of bound and free glycogen fractions in the heart and liver of normal mice at intervals between the ages of 1 day and 90 days have been made. The cardiac glycogen concentration is at its maximum (836 mgs. per cent) at birth; the bound fraction comprises 37 per cent of this total. At 4 days of age 50 per cent of the glycogen is depleted and by the ninth day only 23 per cent of the original amount remains, 27 per cent of which is in the bound fraction. At 16 days the percentage of the bound fraction begins to increase and by 18 days exceeds the free fraction. At 22 days total cardiac glycogen amounts to 113 mgs. per cent of which 63 per cent is bound; there is a gradual decline to an average of 70 mgs. per cent attained by 40 days.

Total hepatic glycogen shortly after birth averages 965 mgs. per cent of which 7 per cent is bound. There is a steady decline to the 9 day value of 437 mgs. per cent of which 2 per cent is bound. From the ninth day there is a gradual increase in total liver glycogen to an average value of 1425 mgs. per cent at 18 days. In the ensuing 48 hours there is a sharp increase to a mean value of 4523 mgs. per cent, of which 99.5 per cent is in the free fraction. By the twenty-second day rapid decline to approximately one-third of the peak value takes place. At 21 days the bound fraction comprises 0.6 per cent (17 mgs. per cent) of the total glycogen and 24 hours later it rises to 6 per cent (106 mgs. per cent). The bound fraction attains a value of 9 per cent (177 mgs. per cent) of total hepatic glycogen at about 40 days.

Hydrocortisone acetate, when injected 48 hours prior to sacrifice, significantly increases bound and total cardiac glycogen at 12, 14, 16 and 18 days. The bound fraction exceeds the free fraction at 14 days, 4 days earlier than normal.

Total cardiac glycogen of mice weaned at 21 days fell to 54 mgs. per cent on the twenty-second day, but 24 hours later had increased to 110 mgs. per cent of which 93 per cent was found. Total hepatic glycogen fell to 18 per cent of the normal 22-day value; of this amount 66 per cent was in the bound fraction. By the twenty-third day liver glycogen has increased nearly threefold (752 mgs. per cent), and the bound fraction has declined to 11 per cent.

Diurnal variations in total cardiac and hepatic glycogen have been observed. In the heart peak values occur at 12:00 noon and 12:00 midnight, and low values at 8:00 A.M. and 4:00 P.M. In the liver the peak occurs at 4:00 A.M. when 99 per cent of the glycogen is in the free fraction. There is a steady decline to 8:00 P.M., the low point in the curve. When free glycogen commences its rapid decline after 4:00 A.M., the bound form continues to increase to 12:00 noon and remains relatively stable from this time to 4:00 P.M.

The data presented strongly implicate alimentation and adrenal function with the maintenance of the normal pattern and range of diurnal variation in cardiac and hepatic glycogen and suggest that the bound and free glycogen fractions are meaningful physiological entities which are independent of both sample size and total amount of glycogen present in the tissue. Both fractions appear to be metabolically active.

Microfilm \$2.75; Xerox \$7.40. 158 pages.

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

THE CYPRUS QUESTION IN THE BRITISH HOUSE OF COMMONS, 1954-1959.

(L. C. Card No. Mic 60-6439)

Evalyn Cumblidge Aligwekwe, Ph.D.
Bryn Mawr College, 1960

This dissertation has used the Cyprus struggle for self-determination as a case study in the colonial views of British political parties as expressed in the House of Commons debates since World War II. Cyprus was chosen because it is a "strategic" colony, located in the Eastern Mediterranean, a part of the world in which the British still believed they could maintain an imperialist position. Attention is focused primarily on the period 1954-1959, but the background of British activity in the island was also examined in order to compare the policies of the three major British parties when they each formed the Government.

While Greek nationalist agitation by a majority of the population had been a permanent feature of the Cyprus scene since 1878, a Parliamentary statement by Mr. Hopkinson, the Minister of State for Colonial Affairs, on July 28, 1954, precipitated a crisis which led ultimately to the replacement of non-violent agitation by terrorist methods in March, 1955. The situation was further complicated by the existence of a substantial Turkish minority in the island which was unwilling to accept the realities of a minority status, and the fact that the Governments of Greece and Turkey took up the cause of their ethnic communities in Cyprus. The problem for the British Government to solve then became that of how to provide Cyprus with a self-governing constitution acceptable to both Governments, as well as to the Cypriot communities, while at the same time retaining British sovereignty over the island, which was considered essential for strategic reasons.

The writer has followed Parliamentary debates, statements, questions and answers, as well as Party pronouncements, throughout the period in considerable detail, concentrating on basic positions with respect to the application of self-determination to the island. The analysis shows that two main party positions were taken on this issue. The Conservative Party, until 1955, refused outright to relinquish sovereignty over the island; after 1955, it would consider this, provided acceptable guarantees of unilateral British use of bases in Cyprus could be found. The Liberal and Labour parties, until 1955, demanded the immediate grant of self-determination to Cyprus, which they regarded as equivalent to union of the island with Greece; after 1955, they demanded a constitution for a transitional period, with a fixed date on which self-determination would be granted to the island.

The settlement which was finally reached, after almost four years of terrorism in the island, made provision for a completely independent Cyprus, to be allied militarily

with both Greece and Turkey, with a certain degree of political partition for the Turkish minority. Great Britain retained complete sovereignty over two base areas, with facilities to make them usable, guaranteed by the Cypriots, Greece and Turkey. The Greek-Cypriots formed the majority in the Government, although there was a Turkish veto on matters affecting Turkish community affairs, but they had to give up their cherished objective of union with Greece. In addition to its complexity, one of the greatest weaknesses of this settlement was that it was initiated by Greece and Turkey. It was prompted largely by their own national interests, rather than growing out of actual internal conditions in the island. It was assented to by the Cypriot communal leaders, but their role seems to have been largely a passive one in the actual negotiations. Moreover, the retention of British sovereignty over two base areas creates further friction points in addition to those inherent in the very governmental structure.

By opposing the tide of nationalism and anti-colonialism, which is the dominant phenomenon in the mid-twentieth century, against the warnings of the Labour and Liberal Party members, in Cyprus, the Conservative Government did considerable damage to the prestige of Britain as an "enlightened" colonial power in the world, and endangered long-term British interests, strategic and otherwise, in the Eastern Mediterranean and entire Middle East.

Microfilm \$6.05; Xerox \$21.40. 475 pages.

THE POLITICAL DRAMA IN AMERICA SINCE 1930

(L. C. Card No. Mic 61-496)

Victor Samuel Bahou, D.S.S.
Syracuse University, 1960

This study seeks to inquire into the social and political aspects of the modern political drama in America. It is concerned with whether or not political dramas reflect a given societal reaction to political institutions and practices. The methodology is historical and analytical. Does the political drama perform either a positive or negative role in social change? Do political dramas, produced on the Broadway stage since 1930, illuminate major aspects of politics and government? It seeks to determine whether it is possible, through a study of political dramas and their themes, to identify and delineate shifts in the political concerns of writers and society. This dissertation deals with a number of political questions which have been projected on the Broadway stage. It considers such topics as American history, biography, totalitarianism, human rights, administrative organization, power and the like. In some instances, there are traced changes in the attitudes of both playwrights and public towards particular political problems such as war, civil rights, bureaucracy, and the cynical pursuit of power.

The analysis tends to support the proposition that political dramas reflect political reality as well as political aspirations. It also considers the function which the political drama can serve as an instrument of propaganda or persuasion, as well as the role of the dramatist as teacher. There is also support for the contention that the political drama lends itself as a stimulating, effective, and provocative teaching device and pedagogical technique. There is also considerable evidence which emphasizes the importance of experience as a source of substantive material for the political dramatist. Attention is also directed to the close underlying relationship between the social sciences and the humanities and the arts.

Microfilm \$3.35; Xerox \$11.70. 258 pages.

**THE POLITICS OF ECHO PARK AND
OTHER WATER DEVELOPMENT PROJECTS
IN THE UPPER COLORADO
RIVER BASIN, 1946-1956.**

(L. C. Card No. Mic 61-82)

Richard Edward Baird, Ph.D.
University of Illinois, 1960

The thesis considers the efforts of people for and against projects for water development in the upper Colorado River basin of Utah, Wyoming, Colorado, and New Mexico from 1946 to 1956 in order to test theories or statements about politics. It is especially concerned with group theories of politics as expressed by Arthur F. Bentley in *The Process of Government* (Bloomington, Indiana, 1935) and by Phillip Monypenny in "Political Science and the Study of Groups: Notes to Guide a Research Project," *Western Political Quarterly*, VII, No. 2 (June 1954), pp. 183-201, and finds that many of the theories seem true. It finds, for example, that groups do seem to change their positions to satisfy other groups whom the groups want to gain as supporters or lose as opponents.

The thesis is also concerned with other theories besides group theories and also finds that many of them seem true. For example, it finds that members of Congress do observe "states rights" in their action.

The thesis starts from the assumption that a great number of theories is necessary to explain the kind of events in which it is interested.

Microfilm \$7.35; Xerox \$26.10. 580 pages.

**JEAN BODIN AND THE 16TH
CENTURY REVOLUTION IN THE
METHODOLOGY OF LAW AND HISTORY**

(L. C. Card No. Mic 61-250)

Julian H. Franklin, Ph.D.
Columbia University, 1960

The last quarter of the 16th century is the beginning of a comparative approach to jurisprudence which is also of great significance for the theory of history. Legal science, hitherto, had been mainly devoted to exegesis of the Roman Law. The premise of the medieval jurist was the

perfection of the *Corpus Juris* as a universal code of jurisprudence. And his adaptation of the Roman sources to the needs of medieval Europe was obscured and hidden, as it were, by a purely casuistic mode of exegesis which permitted free interpretation.

In the later Renaissance the premises of medieval Romanism were undermined by legal humanism which attempted not only to interpret the *Corpus Juris* philologically but to rearrange its contents as the logical components of a single system. As a result of these endeavors it now appeared that the codification of Justinian was considerably less than perfect or complete -- that many of its rules were peculiar to the needs of Rome, that much of Roman legal wisdom had been omitted or imperfectly recorded, and that what was actually included was often inconsistent or chaotic. Thus the unintended direction of the humanist reforms of method was a break with the authority of Rome.

The final consummation of this break is the work of Jean Bodin in public law which reflects a growing movement of the later humanists towards a reconstruction of jurisprudence on a base of universal history. Bodin's method is a comparative study of "the laws of all of the most famous peoples" in order to synthesize the common elements, to classify significant diversities, and to discriminate the major factors of environment and politics to which these diversities are related. With Bodin, therefore, a transition is finally effected from exegesis of authority to a comparative system of jurisprudence. And in some respects the natural law systems of the century which follows, and the comparative jurisprudence of the 18th century, are continuations of his program.

This juristic revolution, furthermore, is intimately related to the beginnings, in the 16th century, of a methodology or general theory of historical criticism. The program of Bodin and his associates is among the most profound expressions of an interest in universal history which is characteristic of the age in general. And it is the universal jurists who play the leading role in the formulation of a method of historical instruction, or "art of reading" for the student, containing all the rules of caution and interpretation which seem of value in the reading of historians.

This construction of an art of reading raises problems in the uses of sources which, up to now, had never been considered systematically. In the ancient world systematic reflection on the art of history was primarily an "art of writing" and was thus restricted to the formulation of principles of style derived from study of the classic models. In the "art of reading," on the other hand, all historians of all varieties are considered as a stock of sources from which the truth about the past must be extracted. And there inevitably arise such questions as the logical status of historical belief, the types of sources and their relative authority, the tests of documents' authenticity, and the indications of an author's biases. Although certain aspects of these questions had been touched upon before, it is only with the work of the jurists, Jean Bodin and François Baudouin, and the theologian, Melchior Cano, that they are systematically related and developed as an elementary methodology of historical criticism. And the influences of this accomplishment may be continuously traced into the 18th century.

Microfilm \$3.15; Xerox \$11.05. 244 pages.

**THE POLITICAL PHILOSOPHY OF
MAURY MAVERICK, SR. WITH
RESPECT TO CIVIL LIBERTIES.**

(L. C. Card No. Mic 60-6799)

Richard Beveir Henderson, Ph.D.
University of Maryland, 1960

Supervisor: Thornton H. Anderson

Maury Maverick was one of the politician-thinkers in the main stream of American political thought of the last three decades who contributed to the flowering of a democratic liberalism which has now captured the American mind and the American political system. The relatively brief span of the phase of his career in which he had his greatest impact (1934-1941) and the passage of the years since have all but obscured his significance.

Cast in the same mold as his ancestor-in-spirit, Thomas Paine, Maverick was a self-taught and fiery publicist who joined political philosophy, an evangelical devotion to the rights of man and practical politics to sustain and enlarge human freedom. He developed no philosophical system. He assumed the essentially democratic system and its spirit, but he joined others in keeping the spirit from dying and in expanding what most of its supporters were willing to have it encompass. Maverick worked in the present for present gains, but he also had an eye to the future and a remarkable prescience as to what could be and what would be.

Like most men, this Texas "maverick" of American politics had his feet of clay. He was sometimes inconsistent and there were times when he clearly departed from his professed principles, but these peccadillos went largely unnoticed in the over-all image which he projected.

Maverick's major contributions to political thought were in the areas of First Amendment freedoms and economic freedom. With respect to the first, he saw the need for dramatizing the dignity and worth of the individual, and he constructed upon that base pragmatic arguments designed to bring about the protection of a near-absolute freedom of expression. He also developed and effectively sustained arguments for a right to be silent as a corollary of the First Amendment right to speak and for a right to free access to information as a corollary to the right to publish information.

Maury Maverick's greatest single contribution was to the development of a successful justification for economic democracy and its ultimate, "freedom from want." He was the equal of any of his New Deal contemporaries in his logical construction of this thesis. He arrived at most of his ideas independently and often in anticipation of his fellow New Dealers. The importance of this concept is that it unraveled the dilemma of trying to square the principles of the Declaration of Independence with the principles of the United States Constitution. Where is the life, the liberty and the pursuit of happiness when many men in an industrial society are denied property or its fruits by the exaggerated protection of a vested right in private property? Maverick effectively demonstrated that there was no freedom without freedom from want and there was not a necessary conflict between the right of each man to some property and the right to be protected in the ownership of property. Maverick's prognostication of economic democracy producing mass leisure in this country is fast

becoming a reality. His optimistic view that this leisure would produce a better man and a better democracy awaits the test of future events.

Microfilm \$4.15; Xerox \$14.65. 324 pages.

**THE SOCIAL AND POLITICAL THOUGHT
OF ADAM FERGUSON: AN INTELLECTUAL
AND THE EMERGENCE OF MODERN SOCIETY.**

(L. C. Card No. Mic 60-5098)

David Kettler, Ph.D.
Columbia University, 1960

The writings of Adam Ferguson, Professor of Moral Philosophy in Edinburgh University during the second half of the eighteenth century, have occasionally attracted the attention of modern scholars who have viewed them as fairly routine expressions of Common Sense philosophy, as historically interesting anticipations of later sociological work, or as sensibly conservative affirmations of a constitutionalism derived from Montesquieu. But these approaches fail to account for two crucial aspects of the works: first, their favorable reception among certain prominent contemporaries and successors of Ferguson, and, second, their formulation of certain key problems which have continued to be the core problems of most social thought since Ferguson's time. As illustrations of the first aspect can be cited the accolades bestowed on Ferguson's writings by such diverse thinkers as Schiller, Marx, and J. S. Mill. To exemplify the second, it is only necessary to note that Ferguson attempted to reconcile analytical philosophy with pre-modern claims in behalf of human reason, modern science with secure and certain knowledge of ends transcending the actual, a naturalistic ethic with a traditional conception of man's capacity to seek perfection, an individualistic view of social life with one dedicated to the communal attainment of the highest goods, and important elements of the liberal theory of politics with a conception of the state as cultivator of moral excellence. Ferguson's undistinguished philosophizing; his ingenious speculations about the implications of the class structure of society, the relation of economic systems to social forms, the division of labor, social conflict, and historical change; and his tame adaptations of Montesquieu's political philosophy -- all these elements of his writings can be properly understood and evaluated only in the context of an analysis which focuses on the over-all nature of his concerns and of his intellectual enterprise.

It is suggested that Ferguson's work can be interpreted most comprehensively and usefully as, above all, the characteristic attempt of a modern intellectual to develop a tenable orientation towards modern society. The role of intellectual, it is argued, took on certain distinctive social attributes in the late eighteenth century, at the time when economic, social and political developments combined to give Western societies their modern form. Certain experiences, commitments, and concerns define the role, and -- it is the main contention of the study -- the social thought of those fulfilling the role has a characteristic pattern and direction which can be described as an explication of the "logic" of the thinkers' situation. A study of

Ferguson's life and work from this perspective, then, can not only show the ultimate unity and integrity which underlie the uncertainties and contradictions presented to a more traditional view, but it can also illuminate some of the major difficulties which are present in all "intellectualist" modern thought. A study of Ferguson as a typical modern intellectual and of his works as the manifestations of an intellectual's striving for practically viable orientation can, in short, elucidate some of the strengths and weaknesses -- even the basic dilemmas -- of the modern intelligentsia.

Such a study requires two steps: first, the use of historical and biographical data to explain the fundamental characteristics of the intellectuals' role and situation in Scotland; second, an explication of the writings to show the relationship between the social and political thought and the functions its development performed for the writer. By pursuing this mode of analysis -- a mode derived from Mannheim's sociology of knowledge -- it is possible to explain why Ferguson came to see social and political problems which have continued to command the attention of modern thinkers, why he found himself compromising his independence as an intellectual to function as an ideologist for dominant political groups, why he disregarded his own sociological insights to spend himself in useless moralizing exhortations, why his ventures into formal philosophy often appear slipshod, inconsistent, and even disingenuous, and why -- ultimately -- his attempt to devise an orientation which could guide him and others to efficacious political practice wholly consistent with his commitments was destined to fail. In conclusion, then, it can be seen that the enterprise of the modern intellectual, as exemplified by Ferguson's works, is -- on the one hand -- inestimably valuable by virtue of the humanistic principles it has upheld and of the contribution it has made to man's self-awareness, and -- on the other -- doomed to frustration. A comprehensive study of Ferguson's work eventuates in a bitter affirmation of the integrity of the intellectual's role.

Microfilm \$6.15; Xerox \$21.85. 483 pages.

**BALFOURIAN CONSERVATISM:
A STUDY IN POLITICAL IDEAS
AND POLITICAL LEADERSHIP.**

(L. C. Card No. Mic 60-3103)

Harry Lazer, Ph.D.
Columbia University, 1960

Arthur James Balfour is generally considered to have been an aristocratic dilettante whose political career was marked by ineffectuality and failure. The purpose of this thesis is to judge his significance by examining his political leadership. This leadership occurred at a time of great economic and social change. Balfour's problem was to adapt traditional conservative principles to the needs of the twentieth century, and to educate his party to meet its responsibilities.

Balfour was an unusual politician in his far-reaching aesthetic and intellectual interests. He was particularly concerned with philosophy and, early in his political career, had written two books on the subject: A Defence of

Philosophic Doubt and Foundations of Belief. These works defended traditional religious faith against the positivistic philosophy then dominant. Balfour ridiculed what he considered an exaggerated respect for reason and an unquestioning faith in scientific laws.

Balfour's political and social ideas reflect a similar distrust of reason. His conservatism emphasized a deep contempt for the application of theory and dogma in politics. Connected with this view was a suspicion of positive governmental action and a traditionalist respect for established institutions. Nevertheless, Balfour was willing to accept and even encourage reform if he felt it was politically or economically necessary and if it could be carried out within the framework of existing institutions.

Balfour's prime-ministry was a moderate success. In the fields of education and temperance, he secured reforms that have stood the test of time. Especially was this true in the field of education, where Balfour's act has come to be regarded as one of the great pieces of social legislation in this century. These reforms did not conflict with his underlying conservatism because they preserved and even strengthened the institutions involved. Only in the field of labor was Balfour unable to apply his constructive conservatism and here his record is justifiably considered a failure.

The successes of his ministry were also dimmed by the bitter and lengthy tariff reform controversy which broke the unity of his party. Balfour did attempt, in harmony with his political ideas, to maintain the existence of his party while developing a practical attitude on the tariff issue. Unfortunately to follow this plan, he tried to avoid conflict by subtlety and evasion.

Balfour's career took an unfortunate turn with the General Election of 1906, when his party suffered a disastrous defeat. Within the party moreover, the tariff reformers emerged as the dominant group. Because of this lack of power, Balfour, as Leader of the Opposition, showed a marked deterioration in his political leadership. The former Unionist blend of traditionalism and practicality was lost.

The primary error of the Unionists was their unrealistic utilization of their great majority in the House of Lords as a party weapon. Even though the party accepted advanced labor and social legislation at this time, the impact of this decision was dissipated because of the omnipresent power of the Lords.

Not only did Balfour's party refuse to recognize practicality, but rejected traditionalism as well. The Unionists, in order to halt the Parliament Bill, advocated proposals, such as the referendum and the fundamental reformation of the House of Lords. These measures, so casually presented by erstwhile Conservatives, had no roots in the history of British politics and attempted to erase centuries of constitutional practice.

These unfortunate years as Leader of the Opposition explain why Balfour appeared as such an uninspiring leader and why there has been so little recognition of his political ideas. Despite his failings as a politician, he was a much more significant figure than he has previously been considered.

Microfilm \$5.95; Xerox \$21.20. 468 pages.

THE BULGARIAN COMMUNIST PARTY, 1934-1944.

(L. C. Card No. Mic 60-5836)

Nissan Oren, Ph.D.
Columbia University, 1960

On September 9, 1944, Bulgaria's old order was overthrown. A government of the Fatherland Front, a wartime underground coalition under Communist sponsorship, assumed control over the country. From the first, emerging from the underground after years of illegal or at best semi-legal existence, the Communist Party of Bulgaria, aided by the presence of the Red Army in the country, played a dominant role in Bulgarian affairs. It is with the development of the Bulgarian Communist Party during the decade immediately preceding the 1944 seizure of power that the present study deals.

The peculiarities of Bulgarian politics in general and the specific conditions of the Bulgarian Communist Party during a period of illegal existence, required that special attention be given to the numerous factions and political groupings making up the Bulgarian body politic. Much of Part One in the present study therefore, is devoted to a description of the non-Communist formations, their origins, their place in the political spectrum, and above all, the personalities of their leaders. The treatment here is essentially functional and the examination of groupings such as Professor Tsankov's "movement," the Zveno group, the Democrats of Malinov and Mushanov, the Gichev Agrarians, the Pladne group, the Radicals and the Social Democrats, centers on the years of the Naroden blok (1931-1934), the last time Bulgarian enjoyed any semblance of political freedom, Part One closes with a brief treatment of the Zveno putsch of May 19, 1934.

The development of the Bulgarian Communist Party from the purge of its "left sectarian" elements in the aftermath of Dimitrov's rise to world fame at the Leipzig trial, to the collapse of the Soviet diplomatic offensive for the conclusion of a treaty of non-aggression with Bulgaria in the winter of 1940-1941, forms the bulk of Part Two. The origins and nature of the so called left sectarian domination, the return from the Soviet Union of Dimitrov's emissaries, and the closing of the intra-Party purge in the months following the Seventh Congress of the Comintern in 1935, occupy most of the opening chapter. The following chapter deals with organizational problems of the Party after the dissolution of the Workers' Party and the other Communist fronts. The "turn to the right" and the Communist efforts for the establishment of a popular front follow. Part Two ends with an examination of the reactions of the Bulgarian Communists to the Munich agreement, the Russo-German Pact, and the Soviet-German diplomatic rivalries over Bulgaria in the fall of 1940.

The third and last part of the study is devoted to the Party's fate in the years between Bulgaria's entry into the Tripartite Pact in 1941, and the Fatherland Front coup of September 1944. The first two chapters center on Communist reactions to the Nazi attack on the Soviet Union and the Macedonian policies of the Bulgarian Communists vis-a-vis the Communist Party of Yugoslavia. The Bulgarian Communist armed resistance effort against the wartime Bulgarian regimes is traced and evaluated in the chapter that follows. Part Three concludes with an extended treatment of wartime Communist inter-party maneuvers aimed

at the establishment of a united opposition front. The Bagryanov regime in 1944, the ill-fated government of Muraviev, and the coup of the Fatherland Front constitute the closing chapter of the study.

With few exceptions, all materials made public by the Bulgarian Communists after 1944 have been available for examination. Among them, of major importance have been stenographic reports of Party meetings, Communist pamphlets and leaflets, and above all, a complete collection of the Communist daily press since September 1944.

Microfilm \$5.40; Xerox \$19.15. 423 pages.

IDEOLOGY AND FOUR RADICAL NOVELISTS: THE RESPONSE TO COMMUNISM OF DREISER, ANDERSON, DOS PASSOS, AND FARRELL.

(L. C. Card No. Mic 60-6768)

Robert Liedel Rothweiler, Ph.D.
Washington University, 1960

Chairman: Professor Roy C. Macridis

This study is an attempt to describe and interpret the nature of the relationships that developed between a certain group of major American novelists and the Communist party movement. The members of the group that have been chosen were, during certain periods of their lives, sympathetic to and associated with the movement. The novelists selected are: Theodore Dreiser, Sherwood Anderson, John Dos Passos, and James T. Farrell. Besides their sympathy for the Communist party movement, these novelists were chosen also because they exhibited certain other similarities. All of these novelists have contributed significant works to American literature; all have developed social protest themes in their writings that were directed against the way American society functioned; and all, at one point or another, have thought that a thoroughgoing transformation of American society was necessary. The study was focused on questions such as these: What made the Communist party movement attractive to these four novelists? What was the nature of their response to the movement? What was their image of Soviet Russia? What were they critical of in American society? Does the behavior of these four novelists provide data for useful generalizations about the relations between American intellectuals and writers and the Communist party movement?

The novels, short stories, articles, and letters written by the four novelists have been the main sources of data. Useful data were also found in radical periodicals such as the New Masses, the Partisan Review (later the Partisan Review and Anvil) of 1935 and 1936, and in liberal periodicals such as The New Republic, The Nation, and The Saturday Review of Literature.

While the attraction of Communism to many has been explained as a function of a disturbed self that sought compensation, this cannot adequately explain the attraction of these four novelists to the Communist party movement. Dreiser clearly documented the growing economic inequalities in American society that required a shift in liberal, democratic thought away from economic individualism and to equality of opportunity and, to a lesser extent, equality

of reward. Anderson poignantly described the destruction of traditional small town values by the coming of the machine. Farrell pictured the failure of the urban community to implant worthwhile values into its young people. Dos Passos ruthlessly exposed the crude materialism in America that produced fragmented, pathetic people. Their social protest made them responsive to the great social experiment that they thought they saw taking place in Soviet Russia. As Stalin consolidated his position and the totalitarian aspects of Communism became more obvious, and as the American Communist party proved weak and disorganized, Anderson, Dos Passos, and Farrell drew away from the movement. Dreiser, however, maintained his support for Soviet Russia. He became a party member in 1945 shortly before he died.

These four novelists have provided discerning interpretations of certain aspects of recent American political history. Also the nature of their response to Communism is valuable in understanding the appeals of Communism during a certain historical period.

Microfilm \$3.75; Xerox \$13.30. 292 pages.

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

FOREIGN POLICY POSITIONS OF SELECTED STATES AS EXPRESSED IN THE GENERAL ASSEMBLY OF THE UNITED NATIONS

(L. C. Card No. Mic 60-6983)

John Rose Faust, Ph.D.
The University of North Carolina, 1960

Supervisor: S. Shepard Jones

The documentary record of roll-call votes and supporting speeches and statements in the General Assembly of the United Nations is utilized for the purpose of comparing the foreign policy of ten states--Australia, Egypt, India, Mexico, the Philippines, the Soviet Union, Sweden, the United Kingdom, the United States and Yugoslavia--on three types of issues--the East-West political rivalry, Western colonialism, and economic development assistance to under-developed states. The analysis covers the first thirteen sessions of the General Assembly--1946 through 1958.

Chapter one is a comparative analysis of the internal and external factors affecting the policy positions of the selected states on the three types of issues. Chapters two through eight compare the policy positions of the selected states on various facets of the three types of issues and include fourteen voting tables showing how the ten states voted on the roll-call votes included in the study. A modified version of the Guttman scaling technique is used in the construction of the tables. This makes it possible to rank the ten states in terms of negative or positive responses on East-West political issues, Western colonialism, and economic development assistance to under-developed states. In order to compare the alignments of the

selected states to those of the other members of the United Nations, fourteen additional tables are included which show the alignments of all the member states. These tables include votes selected on the following basis: first, votes are selected from the ten-state voting tables which are thought to be representative of the different patterns of alignment of the ten states; second, votes are selected on the basis of whether they are representative of the different issues relating to the votes in the ten-state tables.

Chapter IX presents the conclusions derived from the study. The behavior of the selected states is given special attention. The study shows that no two of these states take identical positions on all three types of issues being examined, and the differences in their policy positions are explained, with special attention being given to the different kinds of neutrality policies followed by Sweden, India, Egypt and Yugoslavia. Also, it is significant that the United States and the Soviet Union voted differently on nearly every roll-call vote included in the study, whether it concerned East-West issues, Western colonialism, or economic development assistance to under-developed states.

Observations are then made concerning general attributes of international behavior during the post-World War II period, with special attention being given to the manner in which East-West issues, Western colonialism and economic development assistance to under-developed states are interrelated. The voting alignments of all the member states on East-West issues show there was a trend towards bi-polarity during the immediate post-World War II period. However, during the post-Stalin era the most noticeable trend was towards non-alignment, with a growing number of states refusing to support the policy positions of either major power bloc. Throughout the post-World War II period there has been a trend towards bi-polarity in the voting alignments on issues relating to Western colonialism and economic development assistance to under-developed states; the minority voting bloc included the highly industrialized states of the West, and the majority voting bloc included the under-developed and newly independent states of the world as well as the Communist members of the United Nations.

Appendix A discusses the utility of using the Guttman scaling technique for analyzing voting alignments in the General Assembly of the United Nations. Appendix B includes the substance of the resolutions and motions relating to the roll-call votes included in the study.

Microfilm \$6.50; Xerox \$22.95. 509 pages.

THE ANGLO-FRENCH-RUSSIAN NEGOTIATIONS OF 1939

(L. C. Card No. Mic 61-508)

Joseph Anthony Francello, D.S.S.
Syracuse University, 1960

This is a study of an important series of events which took place immediately prior to the outbreak of the Second World War and which are referred to as the Anglo-French-Russian negotiations of 1939. A great deal of controversy has arisen concerning the conduct of these talks and there has been a pressing need for an analysis detached as far as possible from the national points of view of the Powers

involved. This study is an attempt to present such a version of this very significant diplomatic undertaking which carried with it the hopes and fears of millions of the world's peoples.

The first chapter deals with the national objectives and suspicions of the three major Powers directly involved in the negotiations. Britain, France, and Russia had certain national objectives which they hoped the negotiations would help achieve. They also harbored certain suspicions which influenced their actions and tended to narrow their outlook. It is indeed ironical that one of the stumbling blocks to the negotiations was a suspicion which all three parties held in common--a strong doubt as to the sincerity of the other side.

The second chapter follows the course of the negotiations with all its twists and turns. It is a chronicle of proposals, counter-proposals, and new proposals, punctuated by doubts, reflections, and recriminations. Under the stress and strain of the talks, human frailty is often revealed in the errors, pique, and plain stubbornness which marked the actions of some of the personalities involved. It is not a pleasant tale and gives rise to speculation concerning present attempts at settling East-West disputes.

The third chapter concerns the efforts to arrive at a military agreement while the political agreement was left in a state of suspended animation. The political talks, which had started in the middle of April 1939, had reached a deadlock by the end of July and it was hoped that a military agreement could smooth the way for an eventual politico-military accord. The French and British military were no more successful than their counterparts in the diplomatic corps. The unanswered questions of the political negotiations doomed their efforts at arriving at an agreement on the military level. A deadlock was reached in the military talks and before the British and French Governments could agree on what to do about this deadlock the negotiations were shattered by the bombshell of the Russo-German Pact of August 23, 1939.

The latter part of the third chapter deals with the rather pitiful spectacle of the stranded British and French military missions in Moscow wondering what to do next. They were finally ordered home and the Anglo-French-Russian negotiations came to an abrupt end.

This study is not an attempt to fix the responsibility for the failure of the negotiations. It is felt, rather, that a thorough study of the material available, for the purpose of presenting a clearer picture of what took place during the talks, will constitute a more worthwhile contribution to the social sciences than entering into partisan debate on the subject.

Microfilm \$3.45; Xerox \$12.15. 266 pages.

**THE ANGLO-NORWEGIAN FISHERIES
CASE OF 1951: ITS ROLE IN THE TRANSITION
OF THE LAW OF THE TERRITORIAL SEA.**

(L. C. Card No. Mic 60-6672)

Teruo J. Kobayashi, Ph.D.
The University of Florida, 1960

The law of the sea as a customary law has developed through the interaction of various interests of states,

greatly influenced by their economic, political, social and geographical factors. Thus, many aspects of the law have been flexible and general in nature, and in fact uncertain. With the turn of the nineteenth century and the beginning of industrialization this became more pronounced. The attention of states to more expanded activities in the sea adjacent to their coasts arose out of the revolutionary progress of technology, which in turn transformed the nature of the law of the sea and increased the uncertainty and flexibility of the law. Twice in the last half century, therefore, international conferences were called to rectify the situation of the law.

In the light of this uncertain and transforming law of the sea, the present study has investigated the role of the Anglo-Norwegian Fisheries Case which was decided by the International Court of Justice on December 18, 1951. The study is limited, in the broad background of the law, to two aspects of the law of the territorial sea: the role of the case in the extent of the sea and in the questions as to the baseline from which it is to be delimited.

The study is pursued in three major divisions: the background of the traditional law as to the above two aspects, prior to the Fisheries Case; the legal analysis of the case itself; and the subsequent developments in the law as they have been influenced by the case.

From this study it is found that the Fisheries Case has played a threefold role in the development of the law. First, the World Court, rejecting by a clear majority every contention of Great Britain on the traditional concepts of the law, upheld the Norwegian contentions in general that no hard and fast rules as to the extent and delimitation of the territorial sea existed. Second, in so observing, the Court clarified the general nature and principles of the law based on generality, flexibility and adaptability--epitomized in the words of the Court, the "general direction of the coast" and "application of general international law to specific cases." And implicitly the Court vindicated the transitional nature of the law. Third, such findings by the Court, though on one hand clarifying the traditional uncertainty about the nature of the law, induced several states to resort to more liberal interpretation and application of the Court's announcement of general principles, and thus created a state of confusion and flux on the other hand.

The evidence that the Court's judgment, though correct in its observation of the fundamental principles of the law, did not provide any set of ready-made objective rules, became the basis of the proceedings of the United Nations International Law Commission. These studies in turn became the basis for the United Nations Conference of the Law of the Sea held at Geneva in 1958. Both the Commission and the Conference, therefore, took their approaches to the Fisheries Case and its implications in a conservative manner, succeeding in producing many concrete rules as to the delimitation of the territorial sea. By no means, however, have they relinquished the general principles of flexibility and adaptability invoked by the Court. Within the agreed rules there is found "reasonable and moderate" flexibility.

Thus, the Fisheries Case has played and no doubt will continue to play a prominent and historic role in the development of the customary law of the sea.

Microfilm \$6.90; Xerox \$24.55. 541 pages.

POLITICAL SCIENCE, PUBLIC
ADMINISTRATION

THE IMPACT OF INDUSTRIALIZATION
UPON POLITICS AND GOVERNMENTAL
INSTITUTIONS OF JEFFERSON
COUNTY, TENNESSEE

(L. C. Card No. Mic 60-6999)

John Cripps Brashear, Ph.D.
The University of North Carolina, 1960

Supervisor: Paul W. Wager

This study is an attempt to record and evaluate the impacts of industrialization upon politics and political institutions of Jefferson County, Tennessee. Industrialization, as the word is used in this dissertation, is given a broad meaning which includes other elements of modern civilization that affect the politics and political institutions of the county.

An examination of the minutes of the Court of Quarter Sessions was essential since this is the governing body of the county in Tennessee. However, an examination of all available sources was undertaken in order to ascertain from what direction these impacts came--from the Court or the general will of the people. That is, did the Court take the initiative or did it need to be prodded? If prodded, by whom and why?

With these questions as a guide, this study proceeds to locate and analyze these impacts as they occur throughout the years.

The Justices of the Court opposed the establishment of the Health Department; but they were quite willing to cooperate in the establishment of the Welfare Department since the Federal Government was providing most of the cost of operation.

They also opposed the establishment of a General Sessions Court which, finally in 1960, relieved them, individually, of all criminal and civil jurisdiction.

Zinc, the chief mineral resource of the county, gave the Court, among other things, the opportunity to use its influence and financial assistance in the construction of a railroad which would be located near the zinc mines.

The Court took the initiative in floating the first road bonds in the county; but the people had to prod the Court until 1925 to make appropriations for the advancement of public education.

The paramount conflict occurred when the T V A decided to build Douglas Dam on the French Broad River in 1941. The Court, large landowners, and canning factory executives opposed this construction so bitterly that the issue was not resolved until the attack on Pearl Harbor.

Due to the impacts which affected county expenditures, by 1949 the total bonded indebtedness had risen to over one million dollars--a figure which has never decreased to the present day.

The Court was found willing in the 1950's to install radio equipment in the sheriff's office in order to increase the services of law enforcement. The study concludes with the willingness of the Court to cooperate with the Federal Government in the construction of a fifty-bed hospital which will be located in Jefferson City.

This study revealed that the framework of government in Jefferson County has not changed much through the

years; though new administrative offices have been instituted to provide for additional services required by an advanced technology, and an increasing interdependent society.

Moreover, when these numerous impacts are analyzed, the total evaluation is generally in favor of the Court though at times slow in yielding to the demands of the people and to the democratic process.

Microfilm \$3.10; Xerox \$10.80. 239 pages.

THE ADMINISTRATIVE RELATIONSHIPS
OF AMERICAN POINT FOUR PERSONNEL
IN THE INDIAN STATES

(L. C. Card No. Mic 60-6759)

Richard Frank Crabbs, Ph.D.
Stanford University, 1960

This is a study of inter-personal and administrative relationships in the transmission of technical assistance between the nationals of the United States and India. The survey of personnel at the point of international contact sought to discover administrative problems which were created or augmented by the cross-cultural character of this cooperative endeavor. American agricultural advisers and Indian officials were interviewed in five Indian states during the winter of 1953-1954.

Although the inter-cultural differences appeared somewhat less important than anticipated, the values and practices of the Indian governmental services affected the status and work of agricultural advisers significantly. Most of the personal qualifications long assumed valuable in technical assistance were endorsed, but informants also suggested the need for higher intellectual and educational standards in the Indian setting, better use of written and oral English and improved institutional support by the American mission headquarters.

The formal organizational setting was frequently less significant than the working relationships evolved between the Americans and Indian associates--usually quite varied and well above the level anticipated during planning and above the level of previous experience of the advisers. Nevertheless, top Indian administrative personnel continued to consider the Americans primarily as technicians, while the Americans viewed their general advisory role with increasing importance as they moved freely about helping to expedite, provide liaison, and promote cooperative activity within the state governments. The American practical experience and the advisers' ability to solve specific problems were the assets most valued by Indian administrative service associates, but the advisers viewed the importance of their work in rural areas largely in terms of their own orientation and the establishment of rapport at state headquarters where their more significant contributions were made.

The relationships established by the American agricultural adviser in India depended upon the adviser himself, his Indian associates, and the governmental setting. The advisers were perhaps overly cautious. Both they and Indian associates counselled more vigorous and persistent activity in the future and no adviser was counted as exceeding his authority in any degree. Indian associates at

all levels professed inability to anticipate clearly what each adviser could do and were hence dependent upon the adviser, his agency, or the Indian central government for guidance. Both Indian and American informants believed that the U.S. Technical Cooperation Mission in India could have increased the value of individual advisers through more regular and informed supporting activities.

Technical cooperation is something more than the sum of individual efforts of technicians assigned to a country. Technical qualifications and personal traits may enable them to inspire confidence and promote cooperation among their host associates, but their working relationship also depends upon the ideas, attitudes, and personal traits of their associates as well as upon the administrative environment. Human relations, especially between cultures, are sometimes delicate. Establishment of effective person-to-person contacts, and hence the success of technical assistance, depends upon the willingness and receptivity of both governmental parties and their agents, as well as upon their combined skills in perception and adaptation to individual and cultural demands of situations as they unfold.

Microfilm \$3.15; Xerox \$11.05. 244 pages.

**THE NEW YORK STATE ROLE IN THE
DEVELOPMENT OF POWER FROM
THE ST. LAWRENCE RIVER**

(L. C. Card No. Mic 60-5283)

Edward Mordecai Kresky, Ph.D.
New York University, 1960

Adviser: Dr. Franklin J. Leerburger

The development of the International Rapids section of the St. Lawrence River for both navigation and power has concerned the U. S. and Canada for fifty years. The dissertation analyzes the role of New York State in developing power from the St. Lawrence, with emphasis on problems related to the sale of power and to relations between the state and the federal government.

Part I deals with the historical and legal background of the project, reviewing the defeat of plans for private development and ending with the creation of the New York Power Authority in 1931.

Part II examines federal-state relations from 1931-1954 during the long struggle for federal approval of both Seaway and power projects, and ending with the issuance of an FPC license to the Authority.

Part III analyzes the Authority's implementation of State power policy with emphasis on marketing and transmission

and contrasts the implementation with the requirements of the law.

Under the terms of the 1931 Power Act, primary preference in the sale of power was to be given to rural and domestic consumers to reduce monthly utility bills, with sale to industry a secondary use. The Power Authority and Governor Harriman (who under the law had to approve the marketing contracts) faced the dilemma of implementing a policy, in the late nineteen fifties, which reflected early New Deal thinking. The Authority chairman, Robert Moses, notwithstanding the dictates of the Power Act, chose a power marketing policy of economic development for the under-developed area around the Massena power site and over 55 per cent of the power was sold to two aluminum companies, Alcoa and Reynolds. Although this neglect of the law's preference for rural and domestic consumers was severely criticized, the contracts were approved. No attempt was made to amend the state statute and relate it to current conditions. In essence, the law was amended by administrative action.

Despite the deserved criticism of the methods used by the State in marketing and transmitting the power, it must be recognized that the intent of the 1931 law runs counter to the current trend of economic policy in the states, which is to stimulate industrial settlement and growth and bolster local tax rolls. Thus, the decisions made regarding St. Lawrence power were not isolated but were a result of a general evolution of economic policy.

As to federal-state relations, New York's role in the development of the St. Lawrence demonstrates unusual creativity in federalism. Governor Dewey's proposal to separate the power program from the controversial Seaway project, which had long been the stumbling block in securing federal approval, created a set of circumstances in both Ottawa and Washington that finally led to approval of first, the New York-Ontario power project and then of the U. S.- Canada navigation program.

New York was successful in playing a significant role on the St. Lawrence because of its institution of a strong governor and its commitment to positive government. These two factors helped make it possible for the State to withstand the pressure for limited private development of the resource and also pressure for federal operation and control of the power. The international character of the problem offered its governors, nearly all presidential aspirants, a unique opportunity to operate on a wider political stage.

This experience in mutually responsible federalism, involving multi-purpose river development, indicates that a state can contribute significantly toward the realization of national goals, thus affording new evidence that our federal system can produce creativity through inter-action of state and nation. Microfilm \$5.85; Xerox \$20.75. 458 pages.

PSYCHOLOGY

PSYCHOLOGY, GENERAL

THE CONSTRUCT VALIDITY OF ACQUIESCENT RESPONSE SET AS A MEASURE OF ACQUIESCENCE

(L. C. Card No. Mic 60-6617)

Robert John Foster, Ph.D.
The University of Texas, 1960

Supervisor: Dr. Austin E. Grigg

The consistent tendency of individuals to give affirmative responses to statements or to questions independent of the test item content is termed acquiescent response set (ARS). It has been frequently treated in the research literature as a measure of a generalized tendency to acquiesce even though studies have not established that ARS and behavioral acquiescence reflect similar response mechanisms. This study investigates the validity of ARS as a measure of behavioral acquiescence.

An Asch-type conformity situation in which subjects were placed under social pressure to conform to simulated incorrect answers of others, and a compliance situation involving one's willingness to agree to a request, were used as behavioral criteria for acquiescence.

In the literature, the assumption is also usually made that all measures of ARS are approximate equivalents. The present study investigates the differential effects of two item characteristics, social desirability and probabilistic-vs.-overgeneralized wording, on the individual's relative tendency to give acquiescent responses.

Two measures of ARS used in the investigation were (a) a true-false test containing extremely difficult items and (b) an aphorism questionnaire that was counterbalanced for social desirability and for the extent to which the wording was probabilistic or overgeneralized (e.g., "some men are self-centered" vs. "all men are self-centered"). On the aphorism questionnaire, subjects marked specified degrees of agreement or disagreement. One hundred and fifty college freshmen served as subjects.

Conclusions from the data are as follows:

1. On the aphorism questionnaire, when the ARS score was based on the traditional approach of treating all agree responses as being alike, the interrelationship of the ARS scores based on the various response alternative (e.g., strongly agree, moderately agree, etc.) suggest that some other response set or sets tend to confound the measurement of ARS, although the ipsative nature of the scores prevent any definitive and final conclusion.
2. Empirical evidence and common sense considerations suggest that at the present stage of knowledge in field it is best to treat "strongly agree" responses separately from "moderately agree" responses.

3. The ARS scores on the true-false test and the aphorism questionnaire were only moderately related when the "strongly agree" responses were scored.
4. On the aphorism questionnaire the overgeneralized-probabilistic dimension did not differentially affect the relative tendency of subjects to exhibit ARS.
5. The extent to which items were judged to be socially desirable tended to have a differential effect on an individual's relative ARS score, i.e., subjects tended to be ordered differently on socially desirable items than on socially undesirable items.
6. With one exception, none of measures of ARS correlated with the behavioral measures of conformity or compliance, regardless of the response alternative or the item characteristic used in obtaining the ARS scores. This one exception, when the large number of coefficients computed is considered, probably represents a Type I error.
7. Any purported measure of ARS should always be clearly qualified as being limited to a particular type of stimulus situation.
8. The results question the assumption made in the literature that ARS is a measure of a generalized tendency to acquiesce and suggest that the label "acquiescent response set" is misleading and inappropriate.

Microfilm \$2.75; Xerox \$5.40. 109 pages.

AN INVESTIGATION OF ONE DIMENSION OF PERSONALITY, SELF-ESTEEM, AND ITS RELATIONSHIP TO A PUPIL'S ART EXPERIENCE.

(L. C. Card No. Mic 61-420)

Frances Dolores Hine, Ed.D.
University of Maryland, 1960

Supervisor: Professor Walter B. Waetjen

Purpose

This research was an exploratory investigation of one dimension of personality, and its relationship to a pupil's art experience. The objectives of the study were: (1) to ascertain a pupil's self-esteem, (2) to ascertain a pupil's self-esteem in relation to art experience, and (3) to determine the effect of selected art experiences upon a pupil's self-esteem, his attitudes toward art experience, and his behavior in art experience.

Procedures

A total of one hundred fifteen pupils attending two sixth grade elementary schools composed the sample. The pupil sample was determined by the selection of classroom teachers based upon established criteria. Before and after measures were used with experimental and control groups. The experimental groups participated in a series of selected art experiences; the control groups continued with the regular program of art activities. The content of selected art experience included working with the visual element of color, constructing with concrete materials, and developing skill in drawing. The experimental period was eighteen weeks.

Criteria for the collection of data included two instruments of a standardized type and three developed by the investigator. Data were collected on the total sample to test the general hypothesis. A random sample of twenty-six pupils was drawn to test four sub-hypotheses. Observational techniques were employed in the collection of these data. The .05 level of confidence was chosen for statistical significance.

Findings

The general hypothesis to be tested was that after selected art experience there will be no difference between pupils of the experimental and control groups on the level of self-esteem, attitudes toward art experience, and verbal responses about self in relation to art experience. There was no conclusive evidence to show a significant gain toward a positive direction in the level of self-esteem and attitudes toward art experience. A significant difference at the .05 level of confidence was revealed from data on verbal responses about self in relation to art experience. This finding indicated that pupils from the experimental groups were able to perceive and to evaluate their art experience at more complex levels of self-meanings than were the control groups.

Data collected to test four sub-hypotheses were categorized and comparisons were made between pupils who varied on levels of self-esteem and attitudes toward art experience. It was found that pupils with high self-esteem and positive attitudes toward art experience showed no significant difference on the level of involvement in art experience. A significant difference at the .02 level of confidence was found on verbalization about self in their responses to art experience.

Pupils with high self-esteem and negative attitudes toward art experience did not show significant differences on the level of involvement in art experience or in verbalization about self in their responses to art experience.

Data on pupils with low self-esteem and negative attitudes toward art experience could not be tested because not enough pupils qualified for this category.

Pupils with low self-esteem and negative attitudes toward art experience showed no difference on the level of involvement or verbalization about self in relation to their art experience. Comparisons between pupils with low self-esteem and negative attitudes toward art experience and pupils with high self-esteem and positive attitudes toward art experience revealed that the former group were found to be significantly different at the .02 level of confidence on the level of involvement in art experience. Comparison of data on verbalization about self in relation to art

experience showed no significant difference between these two groups. Microfilm \$2.90; Xerox \$10.15. 222 pages.

INSTRUCTOR INFLUENCE ON SUBSEQUENT STUDENT PROGRESS IN A PHYSICAL SCIENCE COURSE

(L. C. Card No. Mic 60-6675)

Charles T. Martoccia, Ph.D.
The University of Florida, 1960

The purpose of the present study is to investigate the relation between instructors and the subsequent performance of their students.

Subjects were about nine hundred University of Florida students enrolled in "C-2--the Physical Sciences" and their instructors for the year 1958-1959. The first semester of C-2 (C-21) is a general course in physical science. For the second semester (C-22), a student chooses one of several specialties for further study; the three possible variants in 1958-1959 were astronomy, geology, and physics.

The relation between instructor and student progress was investigated in two ways: 1. The relation between C-21 instructors and their students' choice of variant in C-22. 2. The relation between C-21 instructors and the grades obtained by their students in C-22.

In regard to the question of selection of variant, five null hypotheses were tested:

(1) There is no difference in student choice of second semester variant on the basis of student's first semester instructor.

(2) There is no difference in student choice of second semester variant on the basis of student's sex.

(3) There are no differences among the patterns of progress test grades in C-21 for students choosing different variants in C-22.

(4) There are no differences among the patterns of High School Placement subtest scores for students choosing different variants in C-22.

(5) There are no differences among the patterns of A.C.E. subtest scores for students choosing different variants in C-22.

Hypothesis (1) and (2) were tested by chi square; hypotheses (3), (4), and (5) were tested by analysis of variance.

In regard to C-22 grade, one hypothesis was tested:

(6) There is no difference in second semester student grade on the basis of first semester instructor. This hypothesis was tested by analysis of covariance, with High School Placement Total score as covariant.

Null hypotheses (2), (3), (4), and (5) were rejected. Analysis of the data showed that students of both sexes tended to take geology rather than astronomy or physics. Students were, however, relatively more likely to enroll in astronomy or physics--if they were male, if they had done well on the C-21 progress tests (especially the tests on which the subject matter of astronomy or physics was heavily weighted), or if they had scored relatively high on the High School Natural Science, High School Mathematics, or A. C. E. Quantitative tests.

When data for instructors with small numbers of

students were omitted, null hypothesis (1) was rejected. Separate analyses for male and female students indicated that instructors significantly influenced female students only. Null hypothesis (6) was accepted so it was concluded that if instructors influenced the subsequent behavior of their students, they did it mainly by influencing the choice of C-22 variant. That is, some instructors might have been able to overcome some of the reluctance of female students to choose astronomy or physics, variants which are probably more difficult and mathematical than geology.

Microfilm \$2.75; Xerox \$4.60. 87 pages.

MENTAL ORGANIZATION AS A FUNCTION OF BRIGHTNESS

(L. C. Card No. Mic 61-305)

Travis Dean Rawlings, Ph.D.
University of Kentucky, 1956

Director: Dr. Betsy Estes

Much research has been done on mental organization during the past two decades. Most of this research has been concerned with the differentiation of mental factors as a function of age. Notable among these investigations were those of Garrett who introduced a developmental theory of intelligence.

The present study was designed to test the hypothesis: mental organization is a function of brightness. Selection of pupils on the basis of intelligence, age, grade and sex factors produced a sample of 918 from 1923 students tested on the S. R. A. Primary Mental Abilities Test. Each age, sex and grade level was divided into "high" and "low" groups on the basis of intelligence test scores.

Intercorrelations among the verbal, numerical and spatial subtests were calculated for each group and subgroup. Significance of differences between correlations, pattern analysis, chi square tests, and factor analysis techniques were employed to discern differences between groups.

Similar analyses were made on 400 entering college freshmen using the results on the American Council on Education Psychological Examination, 184 seventh grade pupils on the California Test of Mental Maturity, 188 college freshmen on the General Aptitude Test Battery, and 618 high school students on the Kentucky Classification Battery.

Within the limitations of the present study the following conclusions were made:

1. Results show that mental organization is not a function of brightness for the age range eleven to eighteen.
2. Differences in mental organization for "high" and "low" groups were significant when formulas for restriction of range were applied to the correlations. Closer organization was shown for "low" groups than for "high" groups. Even though conclusions based on data corrected for restriction of range must be made with caution, it seems to be an appropriate statistic for investigations of this nature.

3. Pattern analysis shows significant differences between the corresponding verbal-spatial-numerical profiles for different brightness groups.
 4. The developmental theory of intelligence or the theory that mental differentiation increases with age was not supported for the age range studied.
 5. The English - Mathematics achievement correlations on the Kentucky Classification Battery tended to follow a pattern similar to the mental factors studied here.
 6. The variability of test scores tended to be greater in the groups of "high" intelligence than in the groups of "low" intelligence.
 7. Further research in this area of mental organization is needed. Similar studies using tests with differing amounts of G or general intelligence might be indicated.
- Microfilm \$2.75; Xerox \$3.00. 50 pages.

THE CLASSIFICATION OF APHASICS

(L. C. Card No. Mic 60-6994)

Donald Clare Ross, Ph.D.
The University of North Carolina, 1960

Supervisor: R. Darrell Bock

A battery of tests was administered to a group of aphasic patients. The test consisted of two groups. One group consisted of tests in which the subjects were required to match one of four pictures to a printed or to an aural stimulus. The other set of tests required the subjects to read aloud and to repeat certain aurally presented stimuli, to write to dictation and to copy printed material, and to name both orally and graphically the objects in a group of pictures. The subjects were also asked to tell the stories which they thought were behind a group of pictures. On the basis of their responses to the latter, they were classified as users or nonusers of jargon.

Both the matching and the nonmatching tests were felt to reflect a complex of component variables. Each group of tests was subjected to an analysis of variance. The tests were scored in such a manner that any main effects would equal zero. Hence, the only parameters remaining were the interactions of the main effects with subjects. The importance of the various dimensions of performance could be tested statistically and the parameter estimates could be used to differentially characterize the performance of the subjects.

Each test was administered in two forms and hence the presence of higher order interactions could be tested. It was found that none existed. Hence the postulated variables combined in an additive fashion to adequately explain the conformation of test scores.

The important variables involved in the matching tests were found to be systematic day to day differences and visual vs. auditory matching. The significant variables involved in the nonmatching items were found to be systematic day to day differences, visual vs. aural input, oral vs. graphic output, and translation between pictures-orthographic,

arabic-phonemic, orthographic-phonemic, and pictures-phonemic symbol systems. In both cases, the day to day variation was small compared to other variation.

It was found that the jargon users tended to do poorly on the matching items. It was concluded that the matching tests required comprehension of language while the non-matching tests required only automatic noncomprehending functioning. The jargon users although they could speak, lacked comprehension and could not use language properly.

It was found that some subjects could be classified on the basis of their parameter estimates in certain of the traditional diagnostic categories. For those who could not be so classified, the tests helped in pointing out particular areas of difficulty.

Broadly the subjects could be grouped into four categories: those with good comprehension and a high level of performance on automatic tasks; those with high comprehension and poor ability on automatic tasks, who may be called expressive aphasics; those with poor comprehension but high ability on automatic tasks, who may be called receptive aphasics; and those who are poor at both comprehension and at automatic tasks, who may be called expressive-receptive aphasics.

In addition to shedding some light on the problem of the classification of aphasic patients, it is hoped the study has demonstrated how analysis of variance can be applied to problems which generally have been attacked by factor analysis. Microfilm \$2.75; Xerox \$4.00. 74 pages.

THE RELATIONSHIP BETWEEN PERSONAL HISTORY CHARACTERISTICS AND THE DECISION TO STAY OR LEAVE COLLEGE TEACHING

(L. C. Card No. Mic 61-431)

Phil Welsh, Ph.D.
University of Maryland, 1960

Supervisor: Dr. Allen R. Solem

The purpose of this study is to examine the relationship between personal history characteristics and the occupational mobility of college and university teachers defined in terms of their decision to stay or leave college teaching.

The two major hypotheses studied were:

1. Items relating to personal history characteristics may be found which differentiate along a stay-leave criterion for present and former college teachers within the disciplines of psychology, chemistry, and English, and for the disciplines combined.
2. The responses to these items may be differentially weighted and then combined in such a manner as to maintain a relationship with the stay-leave criterion for both the original sample and for a similar cross-validation sample.

The items selected obtained information relating to personal characteristics, familial characteristics, educational history, occupational history, social and community activities, and professional activities. These items

were incorporated into a questionnaire which investigated other aspects of occupational choice.

The questionnaire was mailed to white, male present and former teachers in colleges and universities in 17 southern states and the District of Columbia. Two random samples were drawn from the useable return, one constituting the "original" sample and the other constituting the "cross-validation" sample. The "original" sample contained 450 present teachers and 146 former teachers distributed among the three disciplines. The "cross-validation" sample contained 260 present teachers and 59 former teachers.

Using the original sample only, the items were submitted to analysis to determine their relationship with the stay-leave criterion. This analysis was conducted for each discipline and for the combined disciplines.

This analysis yielded 11 discriminating items for psychology, 13 discriminating items for chemistry, 11 discriminating items for English, and 15 discriminating items for the disciplines combined. The results of all four analysis groups suggested three major categories of personal history information as follows: (1) background characteristics, defined in terms of events occurring prior to entering college; (2) mobility characteristics; and (3) affiliative characteristics. With respect to the latter two categories, the items and their discrimination patterns were practically identical for all disciplines. With respect to background characteristics, the disciplines differed in terms of the specific discriminating items. Items unique to a discipline and not falling into one of the major categories were found, but they were few in number.

For all analysis groups, significant mean differences were found between criterion groups of both the "original" and "cross-validation" samples, indicating substantiation of the original analysis and of the weight assignments. Comparisons between like criterion groups of the two samples suggested cautious interpretation of the validation obtained since significant mean differences were found between the leave samples of two disciplines and between the stay samples of the combined group. With respect to the significant differences between the leave samples, sampling bias seems possible as a function of the small "cross-validation" leave samples used. Additional investigation indicated that the discipline of English was responsible for the significant difference, which dictated cautious interpretation, in the combined analysis.

The results of this study offered substantial support for hypothesis I and partial support for hypothesis II.

Microfilm \$2.75; Xerox \$6.60. 137 pages.

PSYCHOLOGY, CLINICAL

**IDENTIFICATION DIFFERENCES BETWEEN
ACCEPTED AND REJECTED
CHILDREN AT ONE CRITICAL STAGE
OF EGO DEVELOPMENT**

(L. C. Card No. Mic 60-5526)

Theodore Shriver Baumberger, Ph.D.
The University of Oklahoma, 1961

Major Professor: Alfred F. Glixman, Ph.D.

A limited aspect of Ausubel's theory of ego development was used as the basis for several predictions concerning differences in ego structure, identification processes and perceptual-cognitive abilities in satellizers and non-satellizers. Ausubel characterizes satellizers as being emotionally accepted and intrinsically valued children who dependently identify with their parents. Non-satellizers are seen as being rejected or extrinsically valued children who remain precociously independent, self-willed, and non-subservient in their relationships with parents.

Two main predictions were derived from Ausubel's conception of the satellizing process:

1. Non-satellizers have less healthy personality structure than do satellizers.
2. Non-satellizers exhibit more analytic and independent behavior in perceptual tasks than do satellizers.

These statements were tested by techniques derived from theoretical contexts other than Ausubel's; namely, by the Rorschach and the Children's Hidden Embedded Figures test.

Forty-two male children, seven to nine years of age, were used as subjects. Half of them were satellizers; the other half were non-satellizers. The non-satellizers were residents of two institutions for "dependent and neglected" children; in addition, they perceived themselves as rejected or extrinsically valued by their parents (as indicated by scores on the modified Parent Attitude Rating Scale). In order to minimize the effects of institutionalization, no non-satellizer had been in an institution for more than two years.

The satellizers were children who were matched with the non-satellizers with respect to age, socio-economic status, religious and ethnic characteristics, physical health, and intelligence. They came from homes in which both parents were present and residing. In addition, they perceived themselves as being accepted and intrinsically valued by their parents on the PARS. Thus, two distinct groups were formed for the research.

A series of specific predictions was derived. Essentially, those related to personality structure were tested by using the Rorschach; those related to perceptual efficiency were tested by the Children's Hidden-Embedded Figures test.

Rorschach responses were analyzed by means of a sign approach based on first responses and by means of a global evaluation based on the total record. Nine of fifteen signs differentiated the two groups in the predicted direction, as did judges' ratings on the global interpretation.

On the CHEF test, non-satellizers differed significantly from satellizers in isolating embedded figures more rapidly and in making fewer dependency appeals.

It was concluded that Ausubel's statements about

satellizers and non-satellizers were supported by the data. A description of non-satellizers and satellizers in non-Ausubelian (i.e., in Rorschach and psychoanalytic terminology) terms was offered. Some implications for future research were indicated.

Microfilm \$2.75; Xerox \$4.80. 93 pages.

**LEARNING AND GENERALIZATION
OF A VERBAL RESPONSE CLASS AS
A FUNCTION OF LEVEL OF AWARENESS**

(L. C. Card No. Mic 61-499)

Stanley Edward Bell, Ph.D.
Syracuse University, 1960

It was the aim of the present study to investigate the effects of different levels of awareness on the learning and generalization of verbal responses. The theoretical framework was Dollard and Miller's learning theory which defines awareness in terms of labeling. A person is aware of a response when he is able to attach a verbal label to it. Dollard and Miller would predict that the labeling of a response class is necessary for the occurrence of secondary generalization. They would maintain that only primary generalization would occur without awareness. The crucial difference between primary and secondary generalization is in the use of verbal labels. Secondary generalization refers to the mediation of members of a response class by the use of the label of this class. Primary generalization refers to the evocation by a stimulus complex of a number of responses structurally similar to responses originally connected to this stimulus complex.

The procedure was as follows. A list of 126 words was selected from the Thorndike-Lorge word count. On the basis of preliminary work the words which met the various criteria by being "animate," "structurally similar," or "neutral" were used in the experiment proper. The words, four to a card, were presented to individual Ss who were instructed to select the word which was highest in general frequency of use. Ss in the experimental group were reinforced by E with the word "good" each time they selected an animate term. Ss in the control group did not receive this reinforcement. Following the conditioning trials, tests for primary and secondary generalization were run using other animate, structurally similar, and neutral terms. At the conclusion of the experiment Ss in the experimental group were interviewed to assess their level of awareness. They were classified into three levels of awareness, defined in terms of the events verbalized in the interview.

The following conclusions were drawn:

1. Verbal reinforcement was effective in increasing the response frequency of the members of a response class.
2. Subjects who verbalized the contingency between the reinforcement and the label of the response class showed the greatest increase in the response frequency of members of the response class.
3. Subjects who verbalized the contingency between the reinforcement and any member(s) of the response class showed a significantly greater response frequency of members of the class than control subjects.

4. Subjects who failed to verbalize either of the above contingencies showed a significantly greater response frequency of members of the response class than control subjects.
5. Subjects who verbalized the contingency between the reinforcement and the label of a response class were the only ones who showed a significant amount of secondary generalization.
6. There were no significant differences among any of the experimental groups and the control group on the test for primary generalization. Certain methodological problems make these results inconclusive.

Microfilm \$2.75; Xerox \$6.60. 139 pages.

PSYCHOLOGICAL EFFECTS OF ANTICOAGULANT THERAPY WITH THE AGED

(L. C. Card No. Mic 60-6533)

Barbara Ann Bennett, Ph.D.
Northwestern University, 1960

Director: Robert I. Watson

This study was an attempt to determine, by means of psychological tests, what benefits might result from long term anticoagulant therapy with the aged. More specifically, it was an effort to ascertain whether the use of anticoagulants could retard the psychological decline accompanying the small stroke syndrome in the elderly. The following hypotheses were advanced for study:

1. The level of intellectual and personality functioning of the elderly subjects in this study would tend to decline over the period between testings.
 2. The decline over time in the functioning of patients receiving anticoagulants would be less pronounced than that observed in an untreated group.
- All patients were evaluated initially to arrive at a baseline of their abilities. Following this, half the group received anticoagulants (coumadin) for six months, and half the group served as control patients that received placebo dosages.

Forty eight residents of a private home for the aged served as subjects for this study, although at the time of the posttest this number had decreased to 33. All patients were volunteers, were not markedly deteriorated mentally or physically, and averaged a little under 79 years of age. Subjects of both sexes were used, and the group as a whole appeared to have had approximately average education and socioeconomic backgrounds for their age group. Subjects were categorized into two groups, arbitrarily classified as "more senile" and "less senile," and then the subjects from these groups were divided equally into experimental and control groups on a random basis. Hence experimental and control groups consisted of half "more senile" and half "less senile" subjects.

A battery of seven psychological tests was used, consisting of measures of intelligence, memory, flexibility of thought processes, motivation, general personality functioning, and social competence. Specific tests included in the battery were CVS Intelligence Scale, Wechsler Memory Scale, Graham-Kendall Memory for Designs Test, Color

Naming and Reversal Test, Rate of Manipulation Test, Rorschach, and Vineland Social Maturity Scale.

The following results were obtained:

1. No significant declines in functioning between tests were observed except in terms of memory. The experimental group showed a significant increment in performance on memory tasks.
2. Significant intergroup differences on posttest scores were observed in terms of memory and flexibility of thought processes. No significant intergroup differences were manifested on tasks of intelligence, motivation, general personality functioning, or social competence.

Certain methodological problems that might have contributed to obtaining less positive results were discussed, as was the possibility of factors other than anticoagulants contributing to posttest intergroup differences. Nonetheless, the results did point to possible beneficial effects of anticoagulants in use with the aged, and further investigation of these drugs seems merited. However, the exploratory nature of the study demands caution in both drawing conclusions about the effectiveness of the anticoagulants as stroke preventive agents and in making generalizations from results obtained with a rather strictly delimited sample and techniques.

Microfilm \$2.75; Xerox \$4.40. 85 pages.

PERFORMANCE CHANGES IN REPEATED JUDGMENTS OF SCHIZOPHRENIC VERBAL RESPONSES

(L. C. Card No. Mic 60-6535)

Stanley Blumberg, Ph.D.
Northwestern University, 1960

This study investigated the effects of knowledge of results and of practice in the absence of external reinforcement on clinical judgments. Three groups of naive judges, 30 to a group, were presented with a list of 21 verbal responses previously made by schizophrenic patients. The 21 items were presented six times. The judges' task was to rate each item on a seven-point scale as to severity of disorganization in thinking. One group received only practice in making their judgments; i.e., they were given no information about the accuracy of their ratings. The second group of subjects were told, after each rating, whether their judgments were correct, too high, or too low. The third group was given the correct scale value for each item after each judgment was made. After the six training trials, all subjects were given a new list of 21 items, equated in scale values to the first list. They rated this new list twice without receiving any knowledge about the accuracy of their judgments.

The hypotheses were that the performance of all three groups would improve over the first six trials indicating learning, with Group III showing the most rapid learning, followed by Group II, followed by Group I. An hypothesis with respect to transfer of training was made in which Group II was expected to show the most improvement on the new stimuli, followed by Group I, followed by Group III.

Five measures of learning were obtained: judgmental response time, number of shifts in judgments from one trial to the next, size of shifts in judgments from one trial

to the next, reliability of the ratings in terms of interjudge agreement, and validity of the ratings as determined by correlation with standardized values of the stimuli.

The different measures gave different results. In terms of response times all three groups significantly decreased over the first six trials at the same rate indicating that they learned at the same rate. When switched to new stimuli, average response times for all three groups increased to the same level as on trial one, suggesting no transfer of training. As for number and size of shifts in judgments between trials, all three groups significantly decreased with Group II showing the greatest amount of shifting, followed by Group III, followed by Group I. Group III showed the most rapid increases in reliability and validity over the first six trials. Group II's reliability and validity also increased significantly but at a slower rate than Group III. Group I showed a slight increase in reliability and validity reaching their highest level at the third trial. Reliability and validity of Group II's and Group III's ratings on trial seven were higher than their ratings on trial one, but not significantly higher than Group I's ratings on trial one, from which it was concluded that no transfer of training occurred. It was concluded that giving judges information as to the accuracy of their ratings produces initially an interfering effect reducing the reliability and validity of their ratings, but later results in their memorizing the correct ratings which produces very high validity and consequently reliability (interjudge agreement). Whether judges are given information as to correct ratings or not, repeated presentations of the same stimuli lead to rote memorizing rather than continued judgment, with the no information group memorizing their own previous responses to the stimuli, and the other groups memorizing the correct ratings which then become their own responses on subsequent trials. There was no evidence that practice alone leads to more reliable and valid judgments.

Microfilm \$2.75; Xerox \$3.00. 56 pages.

PARENTAL CHILD-REARING ATTITUDES AND THEIR CORRELATES IN ADOLESCENT AGGRESSION

(L. C. Card No. Mic 60-6608)

Sherwood Bruce Chorost, Ph.D.
The University of Texas, 1960

Supervisor: Dr. Ira Iscoe

The major aim of this investigation was to study the inter-relationships between maternal and paternal child-rearing attitudes and their correlates in overt and fantasy adolescent hostility. Theoretical background was derived largely from the work of Sears and Aaronfreed. The study explored the fruitfulness of a two-dimensional model for describing parental child-rearing values, as developed by Schaefer in his work with the Parent Attitude Research Instrument (PARI). A secondary aim was to study the relationship between adolescent fantasy and overt hostility, with fantasy hostility handled within a conflict frame of reference.

Seventy-nine emotionally disturbed adolescent boys and their mothers and fathers were selected as subjects.

Parental attitudes were assessed through an adaptation of the PARI scales. Adolescent fantasy was measured using a revised scoring system for the Rosenzweig P-F test. In the latter, measures of fantasy hostility (i.e., approach) and fantasy aggression-anxiety (i.e., avoidance) were obtained to comprise the conflict model. A manifest hostility rating scale was constructed as a measure of overt adolescent hostile behavior.

Consistent with hypotheses, maternal and paternal Authoritarian Control attitudes were positively correlated with overt adolescent hostility ($P < .05$), and Paternal Warmth attitudes tended to be negatively related to overt hostility ($P < .10$). Contrary to prediction, parental Authoritarian Control attitudes were not related to fantasy adolescent hostility. Maternal Warmth attitudes tended to be positively related to fantasy aggression-anxiety as predicted, but not Paternal Warmth attitudes.

Although the two attitude factors proved to be orthogonal, findings did not support the interaction hypotheses implied in Schaefer's two-dimensional model. Results suggested, however, that the two dimensions taken in combination yielded tendencies in the prediction direction not observable when considering the dimensions separately. Although the fantasy measures of hostility and aggression-anxiety were significantly related to overt hostility in the predicted directions ($P < .05$ and $P < .01$, respectively), the hypothesis that combining both measures in a conflict model would yield a significantly higher relationship to overt hostility was not supported.

Present results support Sears' identification model. Strict parental disciplinary attitudes tend to be reflected in the level of overt hostility of the child. Paternal Warmth attitudes may, in addition, encourage an inhibitory tendency that blocks the overt expression of hostility. Although Maternal Warmth tended to be positively related to aggression-anxiety in general, the findings do not support the contention of a relationship between parental attitudes and the child's fantasy behavior. These results appear to be inconsistent with the results of Aaronfreed's work. It was felt that these negative findings remain an open question, however, because of certain methodological problems involved. These problems, notably the relative size of the independent variables, may also apply to the relationship between Parental Warmth attitudes and overt adolescent hostility.

Although the data generally falls in the predicted direction it still remains to be demonstrated that the two-dimensional model is a fruitful one in organizing parental attitudes.

That the fantasy correlates of hostility are significantly related to overt hostility is consistent with the findings of Lesser and Kagan and has implications regarding the issue of isomorphism between fantasy and overt behavior. The present data cannot be taken as a crucial test of the efficacy of a conflict hypothesis. Problems of measurement were noted with regard to the limited nature of response yielded by the P-F instrument.

An alternative theoretical model is discussed wherein parental authoritarian attitudes are described as reaction to overt adolescent hostility.

Microfilm \$2.75; Xerox \$5.60. 113 pages.

THE EFFECT OF AFFECTIVE TONE
ON THE VERBAL BEHAVIOR OF
PROCESS AND REACTIVE SCHIZOPHRENICS

(L. C. Card No. Mic 60-6542)

Alan Steyaart DeWolfe, Ph.D.
Northwestern University, 1960

Director: Janet A. Taylor

The present investigation was designed to study further the Process-Reactive distinction in schizophrenia. Process and Reactive schizophrenic groups, each consisting of 15 hospitalized, male Ss classified by level of premorbid adjustment as measured by the Phillips Scale, were compared to each other and a group of 15 hospitalized Normal controls on a task eliciting verbal behavior. Ss were required to make up sentences using a given verb and any one of four pronouns (I, He, She, They). There were 150 verbs, 100 neutral in meaning and 50 affective; Ss were given a series of neutral verbs, followed by the affective verbs and finally, a second series of neutral verbs.

The comparisons of major interest involved differences in reaction time and personal reference (use of "I") measures between neutral and affective conditions. It was hypothesized that the order of groups (when compared on the magnitude of the difference between these conditions) from greatest to smallest would be Reactive, Normal, and Process and that these differences reflect differences in responsiveness to affective stimuli. The same order of magnitude of change was expected for both reaction time and personal reference measures, although the reaction times were expected to increase and personal reference to decrease in the affective condition.

In the main, the hypothesis of differential responsiveness to affective stimuli was verified. In the personal reference measure, the differences between conditions were in the expected direction and the magnitude of the differences fell in the expected order. Further, the decrease in personal reference was significant for the Reactives and Normals but not significant for the Process. These data provided considerable support for the hypothesis of differential responsiveness to affective stimuli in the groups.

Confirmation of the hypothesis of differential emotional responsiveness was also found in the reaction time analyses. The Reactive group exhibited a significant increase in reaction time in the affective condition, as expected, while the changes in the Normal and Process groups were not significant. A possible explanation of the results, in terms of differential degree of personalization of the experimental situation and its relation to emotional responsiveness and interference effects, was proposed.

Microfilm \$2.75; Xerox \$4.00. 74 pages.

MMPI AND DEMOGRAPHIC CORRELATES
OF POST-HOSPITAL ADJUSTMENT
IN NEUROPSYCHIATRIC PATIENTS

(L. C. Card No. Mic 60-6984)

Ralph Patterson Forsyth, Jr., Ph.D.
The University of North Carolina, 1960

Supervisor: George S. Welsh

This investigation represents an attempt to derive some psychological and demographic prognostic indices from hospitalized neuropsychiatric Veterans Administration patients in regard to a criterion composed of three post-treatment adjustment ratings, both six and eighteen months following each patient's completion of treatment. The Minnesota Multiphasic Personality Inventory (MMPI) was used to measure the personality characteristics of the patients; this test was administered at the beginning of treatment and upon discharge so that change scores, as well as initial and terminal characteristics, could be evaluated.

Three different patient groupings, each comprised of 32 subjects, were studied: a non-psychotic group, mostly comprised of neurotic characters and behavioral disorders; an acute psychotic group, including patients with psychotic diagnoses who had been hospitalized a total of less than one year at the time of the study; and a chronic psychotic group, who had psychotic diagnoses and more than one year's hospitalization. In a balanced design each of the three patient groups were subjected to four different kinds of hospital treatments: 24 of the patients, 8 from each patient grouping, had group psychotherapy along with group living and working conditions; another 24 had group psychotherapy, but with the more usual individual living conditions and work assignments; 24 had individual psychotherapy with the individual living and working conditions; and the last 24 were a control group, having no psychotherapy and the individual living and working conditions.

The three post-treatment follow-up ratings were chosen as the criterion in that in previous work with this same data the three ratings had clustered together as a discernible factor and thus might be thought of as a general rating of post-hospital adjustment. Two of these follow-up items were objective, the need for re-hospitalization and the former patient's employment record; the third follow-up item was a rating of the degree of illness evidenced by the former patient as seen by the person or family with whom the patient had resided following hospitalization.

Inspection of the criterion scores indicated there were very few differences between the post-hospital adjustments of the patients in the various treatment conditions; however, there were very significant differences in the post-hospital adjustment of the three patient groups. The acute psychotic patients, as a group, had uniformly high criterion scores, the chronic psychotics had uniformly poor scores, while the non-psychotics had criterion scores which were more equally distributed between these extremes.

The non-psychotic group of patients was described on a continuum of MMPI anxiety, very little ("psychopathic" type profiles) and very much (highly anxious profiles) being more maladaptive in terms of their criterion scores than the moderately anxious group. Life history and treatment variables seemed to bear these results out. Individual predictions of post-hospital adjustment with the signs

developed in the larger group analyses with these patients was more successful than with the other patient groupings.

The MMPI results which differentiated the adaptive and maladaptive criterion grouping of the acute psychotic patients were not the absolute or configural scale scores, in general, but the change scores between pre- and post-treatment. The adaptive group entered treatment with very acute (elevated) profiles which dropped somewhat below the maladaptive group at post-testing; the maladaptive group showed little change in their absolute scores from pre- to post-treatment.

A number of MMPI scales differentiated the post-hospital adaptive and maladaptive chronic psychotic groups; these criterion groups showed minimal pre- to post-treatment change. The "neurotic," rather than the "psychotic," scales of the MMPI differentiated these groups at post-testing; apparently, the amount of complaining about the psychotic ideation was a factor in their post-hospital adjustment. The Finney group psychotherapy scale, as well as improvements in hospital job and ward behaviors, also differentiated these criterion groups.

Microfilm \$2.75; Xerox \$4.80. 94 pages.

A STUDY OF THE EFFECTS OF IMMEDIATELY PRECEDING EXPERIENCES UPON EARLY CHILDHOOD RECOLLECTIONS

(L. C. Card No. Mic 60-6550)

Eleanor Herson Hedvig, Ph.D.
Northwestern University, 1960

Supervisor: Dr. Lee Sechrest

This study was designed to compare the effects of certain experimentally manipulated experiences on early childhood recollections (ECR) and Thematic Apperception Test (TAT) stories. The stability of the memories was tested following the manipulation of two variables, success-failure and hostility-friendliness. A comparison was made with TAT stories collected under the same conditions, since it was previously demonstrated that they are influenced by these variables. A secondary purpose of this study was to verify the relationship previous research obtained between affective tone of early memories and differential memory for successfully and unsuccessfully performed tasks.

Three-hundred sixty college students, 180 males and 180 females, participated in the experiment, which was divided into two major parts. One-half of these subjects experienced success, failure, or neutral conditions on an anagram task, followed by the collection of six early memories or six TAT stories. The other subjects wrote six recollections or six TAT fantasies after instructions were given to them by a hostile, friendly, or neutral male experimenter. Subjects were requested to rate their early recollections or TAT stories on a five-point scale from very pleasant to very unpleasant.

Results of the data analysis indicated that degree of pleasantness scores of childhood memories and TAT stories revealed no significant differences as a result of the experimental conditions. Subjects in all conditions rated TAT productions higher in unpleasantness than early

recollections. This was considered in part a reflection of the particular stimuli used for the TAT responses.

Content analysis showed that the experience of failure significantly increased the production of achievement themes in TAT fantasies, while it did not influence early memories. Similarly, hostility significantly increased the amount of hostile, aggressive, and unhappy themes in TAT stories, but did not affect recollections. These results were considered consistent with the major hypotheses that experiences of success, failure, hostility, and friendliness do not significantly influence early childhood recollections, but do significantly influence TAT fantasies.

One additional comparison of all ECR and TAT groups was made. Individual productivity, as measured by total number of words written by each subject, did not differ from group to group. Thus, the experiences of failure and hostility did not result in a decline of productivity, as compared with experiences of success and friendliness.

An analysis of emotional terms related to the recollections also was undertaken. Although statistical significance was reached with only two term, several trends suggested that these words partially reflected subjects' reactions at the time of testing, reactions which were not expressed in the early recollections.

With regard to the minor hypotheses, results provided no support for the assumption of a relationship between affective tone of the first memory and recall of successes and failures on the anagram tasks, regardless of the order of tasks.

The implications of the major findings of this study were considered in relation to the clinical use of early recollections. Since previous research has supported the use of early memories as a projective test, this demonstration of their stability was regarded as a further indication of their clinical usefulness in revealing permanent personality patterns.

Microfilm \$2.75; Xerox \$5.00. 100 pages.

PERCEPTIBILITY OF EMOTIONAL AND NONEMOTIONAL STIMULI WITH A FORCED-CHOICE METHOD

(L. C. Card No. Mic 60-6563)

Shirley Pade MacIntosh, Ph.D.
Northwestern University, 1960

Recent discussions of perceptual phenomena have suggested that the empirical relationships found between certain types of stimulus materials and thresholds obtained by the ascending method of limits are due to biases in responding rather than differences in perception. The present investigation attempted to investigate implications of this suggested by comparing the perceptibility of emotional and nonemotional words with two methods: the usual ascending method of limits (AML) and a forced-choice technique (FC) designed to minimize the effects of response bias on performance.

Two parallel lists of stimulus materials were employed, each consisting of 16 five letter words, eight of which had been judged to be emotionally unpleasant in meaning and eight of which were emotionally neutral. To provide for a replication of the experiment with each method, each of the

groups was equally divided, subgroups being given a different set of material. For the two FC Groups, the stimulus words were divided into four sets of four words each (all emotional or all nonemotional) and presented tachistoscopically to Ss in sets. On each trial, S was told one of the four words and asked to identify its spatial location. The sets were exposed at eight durations, the fastest selected to produce chance performance and the slowest a high level of accuracy. Identification of each word was required once at each duration level, for a total of 128 trials. In AML Groups, recognition thresholds were established for each word separately by the usual ascending technique. After the tachistoscopic presentation of stimulus slides, each S, independent of group, ranked the words from his list on the basis of their emotional-nonemotional quality.

In each AML Group, the mean threshold for emotional and nonemotional words was computed for each S, and a direct difference *t* test applied to the distribution of the matched pairs. For each group, the mean threshold for the emotional material was significantly lower than that of the nonemotional material, results consistent with the phenomenon of "perceptual vigilance." For the FC Groups, direct difference *t* tests, based on the difference between total per cent correct responses of emotional and nonemotional words for each S, indicated no significant performance differences for the two types of material. Consistent with the over-all results, the ranking data indicated that AML Ss performed significantly better on words rated personally more unpleasant while FC Ss showed no significant performance differences for words rated on either extreme of the ranking dimension.

From the present study, it could not be concluded that threshold differences between emotional and nonemotional stimuli found with the ascending method of limits technique were due to "perception," although it seemed reasonable that failure to duplicate empirical relationship demonstrated with the ascending method of limits with the forced choice technique cast doubts on the perceptual interpretation of the former. Microfilm \$2.75; Xerox \$4.20. 76 pages.

THE ROLE AND INFLUENCE OF SOCIOLOGICAL VARIABLES IN CLINICAL JUDGMENT

(L. C. Card No. Mic 60-6474)

Cullen Joseph Mancuso, Ph.D.
University of Houston, 1960

The main purposes of this study were: (1) to evaluate and compare the predictive power of clinical judgments based upon three conditions, test data alone, sociological data alone, and test data with matching sociological data; and (2) to describe the relationships between specific diagnostic prediction and each of several sociological variables, such as age, sex, education, occupation, marital status, and religion.

The test records, comprised of the WB-I, Rorschach, and W-A-T, and a sociological description of 48 former patients at the University of Texas Medical Branch were given to a group of eight judges. The judges were instructed to make a diagnostic judgment on each patient on

the basis of three sets of data: (1) test data alone, (2) sociological data alone, and (3) test data plus sociological data. The judgments spanned six diagnostic groups: (1) hysteria or hysterical character, (2) narcissistic character, (3) psychopath, (4) paranoid, (5) passive-inadequate personality, and (6) obsessive-compulsive personality. Criteria for these diagnostic groups were taken from authorities in the field of clinical psychology and psychiatry. Each judge was instructed to adhere to these criteria.

A factorial design was employed. The study (N=48) was replicated. The subjects were rotated as to judges and conditions so as to provide a complete counter-balancing of subjects with judges and conditions. There were 12 subjects in each condition.

The study showed that significant differences existed between the predictive power of (1) test data alone vs. test data with sociological data, and (2) sociological data alone vs. test data with sociological data. The predictive efficiency of test data with sociological data was 77 per cent; the predictive efficiency of sociological data alone was 58 per cent; and the predictive efficiency of test data alone was 48 per cent. There was no statistical significance regarding the difference between sociological data and test data. Thus, while both test data alone and sociological data alone may be used to predict diagnosis approximately three times chance expectation, both used conjointly yield significantly better results than either alone.

The study demonstrated that clinicians maintain sociological stereotypes concerning diagnostic groups, and that these stereotypes are reflected in clinical judgments. Commonly held stereotypes of each diagnostic group were described. A highly significant relationship was obtained statistically between diagnostic choice and each sociological variable.

The study showed that, under the three conditions, some diagnostic groups were predicted with greater accuracy than others. However, there was no significant interaction between conditions and diagnosis, i.e., there was no tendency for diagnosis to be predicted with degrees of accuracy which significantly varied as a function of conditions. No difference was found among judges regarding their over-all predictive ability or their ability to predict certain diagnoses. This finding was interpreted as attesting to the equality of diagnostic skill and experience among judges and to the similarity of their theoretical orientations.

The study served to confirm indirectly the notion that clinical judgment is not based solely upon psychological test data, but rather reflects psychological processes, behavioral pathology, sociological variables, and the unique social interaction between clinician and patient. The importance, however, of psychological tests was reaffirmed.

It would appear that future research concerning sociological aspects of clinical judgment should seek to set up systematic rules governing the interaction of sociological data and clinical diagnosis. The diagnostic implication of a bit of sociological information in a context of other sociological data, test data, or any other relevant information could be systematically appraised. Thereby maximum efficiency in the predictive use of sociological data could be described and replicated.

Microfilm \$2.75; Xerox \$5.80. 119 pages.

THE EXPERIMENTAL REDUCTION OF HOSTILITY

(L. C. Card No. Mic 60-6632)

Paul Bertram Rothaus, Ph.D.
The University of Texas, 1960

Supervisor: Dr. Philip Worchel

The purpose of this study was to evaluate the predictions of frustration-aggression theory, Worchel's threat theory, and Horwitz's power theory about the reduction of hostility and the effects of hostility on human performance. Also investigated were the relationships between aggression-anxiety and the expression of hostility, and between habitual hostility and the reduction of hostility.

Six freshman classes in psychology composed of 171 men and 151 women were administered the Hostility-Guilt Inventory factor II (Manifest Hostility Scale, Behavior). Men and women who scored high and low on this scale were selected as *Ss*. Twelve groups of 16 or more *Ss* received an intelligence test administered by an examiner in a manner calculated to provoke hostility. The examiner departed afterwards and in his brief absence the groups were turned over to an assistant. Each group received one of the following treatments: 1) Catharsis: A non-directive ventilation period, 2) Ego-Support: Ventilation, followed by ego-supportive statements from planted confederates. 3) Communication: Ventilation, followed by a request made to the examiner (by a confederate posing as a student) to alter his means of test administration. 4) Control: No ventilation. *Ss* filled out biographical inventories instead.

Prior to the instigation of hostility, and after the treatments for its reduction, *Ss* were tested for hostility toward the examiner (on the Social Sensitivity Scale) and evaluated for adequacy of performance (on the aiming task and on a paper and pencil Koh's Block Design). *Ss* also received post-treatment administration of the Self-Blame Scale, and six TAT cards scored for aggression-anxiety. The various scores were analyzed by analysis of variance and covariance in a Treatments X Replications X Sex X Levels of MHS(B) design (4 X 3 X 2 X 2). The chief findings were as follows:

1. *Ss* under the Communication condition showed significantly less post-treatment hostility toward the examiner than *Ss* under the Control and Ego-Support conditions. The Catharsis *Ss* were indeterminately between the above clusters. These results were construed as supporting predictions from Horwitz's power theory.
2. Performance, as measured by the aiming task, yielded different results for men and women. Men did poorer under the Ego-Support condition than under any of the remaining conditions, among which there were no differences. Women did best under the Control condition, next best in the Ego-Support condition, and poorest under the Communication condition. None of the theories considered gave an adequate over-all prediction of these results. In general what evidence there was contradicted the hypothesis from Worchel's threat theory that catharsis reduces tension and improves performance.
3. Aggression-anxiety was significantly higher in the Ego-Support condition than in the Control and

Catharsis conditions apparently as a reaction to the comments of the confederate, which may have made the *Ss* feel guilty about hostility expressed during the ventilation sessions. There was no evidence that aggression-anxiety caused an inhibition of further expression of hostility toward the examiner, or that aggression-anxiety arose from guilt about the post-treatment ratings of the examiner.

4. *Ss* high and low on the Manifest Hostility Scale (Behavior) did not differ in respect to their reactions to the experimental treatments.

Microfilm \$2.75; Xerox \$5.00. 100 pages.

CONTACT CUE PREFERENCE AS A FUNCTION OF WITHDRAWAL AND REGRESSION IN SCHIZOPHRENIA

(L. C. Card No. Mic 60-5525)

Kenneth Lee Shewmaker, Ph.D.
The University of Oklahoma, 1961

Major Professor: Maurice K. Temerlin

Schizophrenics function in such a way as to prompt observers to call them regressed or withdrawn. The conception of schizophrenia as a withdrawal and/or a regressive phenomenon provides grounds for expecting, in this disorder, a shift towards a greater use of contact cues as opposed to distance cues as criterial attributes in free-choice situations. There is also reason for supposing that the intensity of this shift towards greater contact cue preference varies as a positive function of the extent of chronicity of the disorder.

The purpose of this study was to ascertain whether or not such a shift in cue preference is demonstrable in schizophrenia and whether the shift progresses as some positive function of the extent of chronicity.

The subjects in this study were 30 short-term and 30 long-term schizophrenics and 30 nonpsychotic controls. All subjects were hospitalized, male veterans.

The subjects were handed an object and then given two additional objects, one visually like the first but tactually different and one tactually like the first but visually different. They were then asked to select the object which seemed more like the original one. Each subject was given 20 presentations of objects, each time with the instruction to select the object more like the original one in that set. Tactual cue preference was stated as the percentage of times the object tactually like the first one was chosen.

It was found that both long-term and short-term schizophrenics chose the tactual attribute as critical significantly more often than did the nonpsychotic controls. The difference between the two schizophrenic groups was not significant.

It was shown that the increased contact cue preference among schizophrenics may help to account for various features which have been observed in these patients, especially on the level of cognition and communication.

Microfilm \$2.75; Xerox \$3.00. 57 pages.

TEST-RETEST CHANGES DURING THE COURSE OF HOSPITALIZATION AMONG SOME FREQUENTLY OCCURRING MMPI PROFILES

(L. C. Card No. Mic 61-594)

George Sivanich, Ph.D.
University of Minnesota, 1960

The purpose of the present study was to investigate both elevation and profile changes occurring during the course of psychiatric hospitalization among some frequently occurring MMPI code types. Samples of four, two-digit code types, restricted to only female patients, were obtained from two rather different psychiatric settings. Code types selected for study were "27," "68," "46," and "42." All female cases in the Hastings and University of Minnesota Hospital code files having an initial profile with the requisite code type and followed by a retest were selected to compose the sample. Total sample size for the four code types ranged from 31 to 83.

For each code type, test-retest changes among the eight clinical scales were analyzed by means of a Type I, three-factor mixed-model analysis-of-variance test. The model was a further development of the Greenhouse and Geisser method of using a conservative test of significance to make allowances for the situation where homogeneous variances and equal intercorrelations among scales cannot be assumed. In addition, for each code type separate Type I, two-factor analysis-of-variance tests were computed for each of the 14 scales. Profile changes were evaluated by the Meehl-Dahlstrom rules.

For each code type, retests were separated into those having at least one clinical scale with a T score of 70 or greater, and those having all clinical scales below 70. Among the retests with T scores under 70, the four code types were compared as to scale L test-retest changes and retest scores, using analysis of variance with a Scheffe modification of the significance region.

Frequencies of two-digit and single-scale high points were presented for each code type. Elevation change differences between code types were tested using a nonorthogonal analysis of variance with the Scheffe modification of the significance region. The effects of two uncontrolled variables (treatment and test-retest interval) on elevation changes were evaluated by nonorthogonal analysis of variance and analysis of covariance.

Conclusions:

1. For three of the four code types, there were no differences between the samples of the two hospitals in the magnitude of elevation change, in spite of large differences in terms of treatments and test-retest intervals. A difference among the "46's" was in part the result of a longer test-retest interval among the Hastings sample.

2. Large decreases in elevation took place among the four code types. The two institutions showed no difference in the pattern of retest differences among the eight clinical scales.

3. The "27's" and "68's" showed the greatest decrease in elevation. These differences were not attributable to differences in test-retest time. The "46's" differed from the other three code types in terms of the effects of various treatments on elevation change.

4. Among the "46's," "42's," and "68's," retests with clinical scale T scores under 70 showed much larger increases on scales L and K than retests with at least one clinical scale T score above 70. In contrast, the 27's showed large decreases among the clinical scales without concomitant increases in L and K scale defensiveness.

5. Although the four code types showed a large amount of change in two-digit codes, three code-type combinations accounted for approximately one-half of the retests among the "46's," "42's," and "27's" considered separately.

6. There was some evidence of a general remission or predischARGE profile with clinical scales under 70 and with a slight elevation on scale 4.

7. MMPI profiles did not show much change in the proportion of profiles falling into the neurotic and psychotic categories of the Meehl-Dahlstrom rules.

8. Scale 4 high points tended to repeat on retest more frequently than high points on scales 2 and 6.

Microfilm \$2.75; Xerox \$7.20. 154 pages.

ROTARY PURSUIT PERFORMANCE IN REACTIVE AND PROCESS SCHIZOPHRENICS

(L. C. Card No. Mic 60-3404)

Walter Otis Smith, Ph.D.
Michigan State University, 1959

Major Professor: M. Ray Denny

The present study was concerned with obtaining an objective description of the adaptive responses of process and reactive schizophrenics in a motor learning situation. Performance on a pursuit rotor task was chosen as a convenient method of accomplishing this purpose.

A process schizophrenic is best described as having an early and insidious onset of psychosis with a relative absence of precipitating stress. Typically, he has had an inadequate prepsychotic personality. He shows a tendency to avoid interpersonal contacts and presents a clinical picture of flat affect and a relative absence of confusion.

A reactive schizophrenic, on the other hand, is one with a relatively abrupt and stormy onset of psychosis, usually attributable to a logical and significant stress situation. The prepsychotic personality has been normal or neurotic, rather than schizoid, with perhaps some degree of outgoingness. The clinical picture following the psychotic break is likely to include severe confusion and many affective components.

In the present investigation, Becker's modification of the Elgin Prognostic Scale was utilized for selection of process and reactive schizophrenics from the schizophrenic population of a Veterans Administration neuropsychiatric hospital. All schizophrenic patients who had been diagnosed as psychotic for less than one year were rated on Becker's scale, and these ratings were found to approximate a normal curve. Subjects in the upper and lower tails of the distribution were classified as process and reactive respectively.

Each of the psychotic classes so selected was divided into four groups with 10 subjects in each group. Pairs of groups (10 subjects from each psychotic class) were then assigned to four conditions of spacing and massing of

practice while learning the rotary pursuit task. Massed practice (M) was defined as continuous practice throughout a practice period, and distributed practice (D) was defined as alternating 30 seconds practice and 30 seconds rest. The four conditions of practice were M-M-M, M-D-M, D-D-M, and D-M-M. The first practice period consisted of six minutes of practice for all subjects, the second of nine minutes, and the third of three. The third and final period was massed for all subjects. Two five-minute rest periods separated the three practice periods.

Comparisons between process and reactive patients were made on the bases of time on target, temporary inhibition, conditioned inhibition, warm-up decrement, and time taken to regain set after a rest.

It was found that no significant differences existed among the eight groups at the beginning of practice in the first practice period nor during the entire final period during which all subjects practiced under massed conditions. Thus it is strongly indicated that differences in psychomotor ability or in learning were not the effective factors in bringing about differences in performance.

During the other phases of testing, differences which showed a high degree of consistency with each other were obtained. Statistical treatment of the data provided considerable assurance that these differences did not arise by chance.

The chief findings with respect to process schizophrenics were: They took longer to adapt themselves and enter into the task. After a rest, they also took longer to regain their set and warm up in resuming practice. When continued under the same conditions for successive practice periods, they progressively improved in performance. When shifted from spaced conditions to the relatively more demanding massed conditions, however, their performance was disrupted.

These results were interpreted as indicating that process schizophrenics were hesitant in initiating new activities and prone to withdraw when thwarted. In other words, they avoided a threatening external situation by withdrawing from activity. Supportive evidence for this interpretation is found in studies of "chronic" schizophrenia and in the few reported studies that have made use of the process-reactive concept.

Findings regarding reactive schizophrenics were largely in the opposite direction. They entered into the novel situation more quickly and took a shorter time to regain set after a rest. When continued for successive periods under the relatively undemanding spaced conditions of practice, their performance deteriorated. On the other hand, performance continued to improve with successive periods of massed practice. When conditions of spacing and massing were shifted in either direction, these patients showed relative improvement in performance.

These results were interpreted as evidence that reactive schizophrenics avoided their internal environments by a flight into activity. Then, when increasing skill rendered the easier task less effective as an escape device, satiation set in quickly. Any change in the task, even to more noxious conditions, was therefore reacted to positively.

Some supportive evidence for this interpretation is found in the literature on "acute" or "early" schizophrenia as well as in studies of process and reactive schizophrenia.

In summary, it was concluded that process and reactive schizophrenics demonstrated some real differences in their

responses to the rotary pursuit task, and that these performance differences could best be explained as arising from differing habitual modes of adjusting. These results are viewed as possibly having important implications for prognosis and therapy of schizophrenic patients.

Microfilm \$2.75; Xerox \$6.00. 124 pages.

EFFECTS OF VISUAL AND AUDITORY PRACTICE ON TACHISTOSCOPIC THRESHOLDS

(L. C. Card No. Mic 60-6328)

Robert Lee Sprague, Ph.D.
Indiana University, 1960

The experiment was divided into two main parts: a training part in which samples of ten disyllabic nonsense words were presented to all subjects and a test part in which the tachistoscopic recognition thresholds were obtained for all the disyllabic words and for a list of four common English words. During training the nonsense words were presented at frequencies of 0, 2, 6, 14, and 30 by means of a tape recorder and an exposure apparatus which automatically controlled the intertrial times and the exposure durations for the visually presented words. Four training groups of 20 subjects each received auditory (silent listening to a tape recording of the nonsense words) and/or visual (silent reading of the visually presented nonsense words) training. Each of the training groups received one of the following combinations of practice: visual-visual (V-V), visual-auditory (V-A), auditory-visual (A-V), and auditory-auditory (A-A). Immediately after the training trials were completed, the ascending method of limits was used to establish the visual recognition thresholds of the four English words during three to five minutes of adaptation trials, and then the visual recognition thresholds of all the nonsense words were obtained in the same manner for every subject.

All the training groups except the A-A group showed a significant reduction in mean tachistoscopic recognition thresholds as a function of the frequency of presentation during the training session. There was no significant differences between the slopes of regression lines plotted to the mean thresholds of the V-V, V-A, and A-V groups. These two findings taken together seem to indicate that some variety of visual training is necessary to produce significant lowering of tachistoscopic thresholds.

Although the mean thresholds of the four training groups on the non-practiced English words were clustered closely together, there was a considerable scatter of the mean thresholds on the non-practiced O-frequency words, with the V-V group having the highest tachistoscopic threshold and the A-A group the lowest. This scatter on the O-frequency words was within the limits of random error. However, these data follow the pattern of other empirical evidence, consequently the trend seems to be established that the type of practice received in training sessions affects the tachistoscopic thresholds of non-practiced words similar to the training stimuli.

A detailed analysis of all the responses prior to accurate recognition of a nonsense word revealed a definite gradient of recognizability. From the total number of

tachistoscopic presentations, about 40 to 50% of the left-hand letters were recognized, whereas the right-hand letters were recognized at lower percentages. Using identification of two letters in the left-hand syllable as a criterion of partial discrimination, it was found that frequency of training significantly lowered the number of additional exposures necessary for accurate identification of the complete word after partial discrimination.

Microfilm \$2.75; Xerox \$3.00. 59 pages.

LEVEL OF PERCEPTUAL DEVELOPMENT AS REFLECTED IN RESPONSES TO THE HOLTZMAN INKBLOT TECHNIQUE

(L. C. Card No. Mic 60-6635)

Joseph Stephen Thorpe, Ph.D.
The University of Texas, 1960

Supervisor: Wayne H. Holtzman

Within the framework of developmental theory, a number of investigators have reported relationships between formal aspects of Rorschach performance and various measures of developmental maturity. The present study has investigated the relationships to chronological age of a large number of inkblot scores which are purported to be perceptual indices of developmental level. A new test consisting of two parallel forms of 45 inkblots each was employed to avoid the serious psychometric difficulties of the standard Rorschach. The Holtzman Inkblot Technique (HIT) was administered to four criterion age-groups with mean ages of 9.1, 12.6, 17.0, and 19.5 years. Each group had an equal number of males and females. Following a statistical correction of scores for number of rejections, statistical analyses were made of ten major scoring variables: Location, Form Appropriateness, Form Definiteness, Color, Shading, Movement, Pathognomic Verbalization, Integration, Human, and Animal; as well as of 29 basic pattern scores. The pattern scores were obtained by simultaneously taking into account the single scores on a number of variables for a given response, thereby deriving the equivalent of the Rorschach developmental scores. The 29 basic patterns were concerned with five aspects of inkblot responses:

1. pathologically deviant verbalizations,
2. the formal or structural characteristics of responses in each of the three location categories,
3. modes of adequate organization of blot elements,
4. the degree of form dominance over the determinants color and shading,
5. human movement.

Previous studies with the HIT had already indicated uniformly high split-half reliabilities, as well as high interscorer agreement for the variables in question. These studies also indicated that the two forms of the HIT are equivalent.

Significant age-trends were obtained for five variables: Form Definiteness, Movement, Integration, Human and Shading. Several composite pattern scores were also found

to be related to chronological age: whole responses with high form definite, form appropriate concepts, and responses having a dominance of form over the use of color and shading. No sex differences were found for any of the scores.

Comparisons with the criterion age-groups on each of the 10 variables were made for additional normal and psychiatric groups: normal adult males and females, superior college freshmen, mentally retarded individuals, and chronic schizophrenics. These comparisons supported the variables Form Definiteness, Movement, Integration, and Human as indices of developmental level. The comparisons further indicated that, as with Color, total Shading scores do not directly reflect levels of development, but are analyzed more appropriately in terms of the dominance or subordination of form.

For each of the 10 major variables, analyses of variance were computed for a sample of 197 seventh-grade students constituting a factorial design for sex, IQ, and social status. On the basis of these analyses, it was concluded that none of these variables were significantly related to the four developmental variables.

The higher scores for the group of superior college students on the developmental variables Form Definiteness, Movement, and Human, were reported to be a function of the slight relationships of these scores to each of the highly developed verbal and quantitative aptitudes present in this group.

It was concluded that the findings of this study are in agreement with the sequence of perceptual changes outlined by developmental theory as well as with the results of previous Rorschach studies. The similar developmental trends observed for the variables Human, Movement, and Integration, were interpreted as expressions of the integrative aspect of perception. Suggestions were made for further refinements of the developmental scores of the HIT. The implications of the present findings for future research in the assessment of developmental level among both normal and psychiatric groups were discussed.

Microfilm \$2.75; Xerox \$9.00. 197 pages.

HOSTILITY AND SELF-EVALUATION

(L. C. Card No. Mic 60-6636)

Donald John Veldman, Ph.D.
The University of Texas, 1960

Supervisor: Dr. Philip Worchel

Three measures of hostile feelings and attitudes were used to obtain scores from 80 undergraduate males assigned to a 2 x 2 x 2 factorial design. The independent variables studied were (1) delay in measurement of residual hostility following experimentally-induced frustration, (2) defensiveness (measured by the MMPI K scale), and (3) self-ideal discrepancy (measured by the Worchel Self Activity Inventory).

The following hypotheses were tested: (1) feelings of anger and tension will decrease during the delay period, while hostile attitudes will persist unchanged; (2) defensive subjects will deny feeling angry or tense, will express fewer hostile attitudes, and will develop more aggression

anxiety than non-defensive subjects; (3) self-accepting subjects will show milder feelings of anger and tension, less hostile attitudes, and less self-blaming behavior than self-ideal discrepant subjects; (4) defensiveness and self-ideal discrepancy scores will be negatively correlated.

Scores on each of the dependent variables were subjected to analysis of variance. The dependent variables were also intercorrelated and factor-analyzed. The following conclusions were drawn from the results.

1. The first hypothesis was confirmed. Although self-report indices of feelings failed to show the effects of delay, a projective version of the instrument yielded significant differences. No changes were found over the delay period in either direct or displaced hostile attitudes.

2. The second hypothesis was only partially supported. Significantly more aggression anxiety was developed by defensive subjects during the delay period, but the other two predictions were not confirmed.

3. The third hypothesis also received only partial confirmation. No differences in feelings occurred on the self-acceptance dimension. Although self-accepting subjects did show fewer displaced hostile attitudes, they devalued the frustration agent just as much as self-ideal discrepant subjects. No significant differences in self-blaming behavior were found.

4. Self-ideal discrepancy and defensiveness were found to be negatively correlated, as predicted.

5. The factor-analysis showed that self-report and projective versions of the instrument measuring feelings of anger and tension elicited relatively unrelated sets of scores. The questionnaire and sentence completion test scores used in the study can be represented by three factors which correspond to Rosenzweig's three types of subjective reaction to frustration.

Microfilm \$2.75; Xerox \$5.40. 108 pages.

A DIFFERENTIAL ANALYSIS OF SOME INTELLECTIVE AND AFFECTIVE CHARACTERISTICS OF PEER ACCEPTED AND REJECTED PREADOLESCENT CHILDREN

(L. C. Card No. Mic 60-6798)

Harvey R. Wall, Ed.D.
University of Kansas, 1960

Pupils in 13 fourth grade and 12 fifth grade California public school classrooms were administered the Classroom Social Distance Scale to determine primary peer acceptance and rejection subjects. The rating choice behavior of all children in the preliminary screening was found to differ by sex but not between grades. The primary subjects were then divided into two groups, depending upon their social status, and submitted to differential analyses on twenty-six variables.

Hypotheses to be tested related to general intelligence, readily displayed kinds of intelligence, personality integration, self perception of social status, assessment of social distance from the group, chronological age, socio-economic level of parent occupation, and frequency of acceptability and rejection as related to sex. These variables were derived from the following instruments and observations: WISC, the Tension Index of the Michigan

Picture Test, The Classroom Social Distance Scale, Edward's scale of socio-economic level of parent occupation, and chronological age in months. The significance of the difference between distributions for accepted and rejected subjects by sex were tested with Student's "t" or the Mann Whitney U Test.

Peer accepted boys were compared to peer rejected boys on the twenty-six variables; the same design was followed for the two status groups of girls. Thus, four groups of twenty-five children per group comprised the investigation sample.

FINDINGS

Peer accepted children showed higher general mental ability than did peer rejected children, as well as, abilities that may be readily displayed in the classroom.

Peer accepted boys verbalized more indications of internal adjustment (MPT) than did peer rejected boys while the two groups of girls did not differ.

Peer accepted boys perceived their own status to be higher than did peer rejected boys but there was no difference between the groups of girls.

Peer accepted children assessed less distance between themselves and their peers than did rejected children.

Peer accepted boys were younger than peer rejected boys but the two groups of girls did not differ.

Parents of peer accepted children came from a higher socio-economic level than did peer rejected children.

Girls were more frequently peer accepted and boys more frequently rejected at this age level.

Auxiliary data were presented to show that the relationship between classroom social status and the marital status of parents was not statistically significant. National origin of the children in the final sample indicated a wide range of identities with the greatest range of origins present in the peer accepted groups. Mobility between schools or school districts did not seem to differ between the status groups.

CONCLUSIONS

From this study it seems reasonable to assume that general intelligence may be important in assisting in social perception and adaptability, and in a school setting readily displayed kinds of intelligence (verbal) may aid in obtaining teacher approval which effects peer acceptance/rejection. The specific ways in which socio-economic background affects acceptance/rejection were not investigated.

In retrospect, the use of the MPT to compare groups differing in verbal ability was questioned since the depth and breadth of projective picture stories seems to vary with intelligence as well as with acceptance/rejection.

The sex of pupils seems to be important in peer acceptance/rejection and girls seem to gain teacher approval prior to peer approval. Retentions in grade do not seem to aid in gaining social acceptability by peers. Contrary to other sources the marital status of the family was not related to peer acceptance/rejection.

Microfilm \$2.75; Xerox \$9.00. 200 pages.

EVALUATING ADEQUACY OF ADJUSTMENT IN NORMAL INFANTS

(L. C. Card No. Mic 60-6241)

Irene Hollingsworth Wiemers, Ph.D.
University of Utah, 1960

Chairman: Ernst G. Beier

A sample of 80 normal infants, ten at each four-week age level, from 4 through 32 weeks, was studied with respect to adequacy of psychological adjustment. The criteria of adjustment were (1) ratings on a feeding rating scale and (2) scores on an adjustment check list, based on both developmental data and detailed observations. The 80 infants had been tested with 10 physiological and psychological measures, and these measurements were compared with the adjustment ratings. The physiological measures were respiration, percentage weight gain, activity level, and tissue resistance. The psychological measures were Cattell IQ, Cattell scatter, Gesell DQ, and three measures of scatter on the Gesell. Results were presented by inter-correlations between each of the physiological and psychological measurements, age, and each of the criteria of adjustment.

There was essentially no correlation between the two criteria. Possible reasons for this lack of correlation were discussed. None of the predictor variables correlated significantly with the first criterion, ratings on the feeding rating scale. Three predictor variables -- percentage weight gain, tissue resistance, and Gesell DQ -- correlated significantly with the second criterion, total score on the adjustment check list. Correlations between the predictor variables were not significant when considered by partial correlations in which age was held constant, with three exceptions: (1) Cattell IQ and Gesell DQ, (2) respiration rate and activity level, and (3) to measures of scatter on the Gesell. The multiple correlation, using the criterion of the adjustment check list as the independent variable, and percentage weight gain and tissue resistance as the dependent variables, improved the predictive ability of the dependent variables.

The following conclusions can be drawn from this investigation:

(1) Feeding behavior does not correlate with scores on an adjustment check list as criteria of adjustment in this sample of normal infants.

(2) Findings in respect to the ten physiological and psychological measurements do not successfully predict relative adequacy of adjustment as determined by ratings on the feeding rating scale.

(3) Three of the correlates -- percentage weight gain, tissue resistance, and Gesell DQ -- significantly predict adjustment as determined by scores on the adjustment check list.

(4) A multiple correlation involving the first two of these three predictor variables improved slightly the predictive value of each of them used singly.

(5) Correlations between the physiological and psychological measurements were in general not significant, indicating lack of consistency in predicting adjustment.

(6) The findings of the study throw some doubt on some popular conceptions. These findings include:

(a) Measurements found to be indications of maladjustment in abnormal infants do not predict differences of psychological adjustment in a group of normal infants.

(b) Low percentage weight gain, when applied to normal infants, is not a good indication of poor psychological adjustment.

(c) High Cattell IQ and Gesell DQ scores at the earliest age levels are probably not good predictors of superior accomplishment at later ages.

(d) Test scatter in normal infants does not reflect a relatively inadequate psychological adjustment.

(e) Feeding difficulties do not reflect a relatively inadequate psychological adjustment in a group of normal infants as determined by an adjustment check list based on developmental data and detailed observations.

(f) Isolated indications of impaired functioning may be found in normal infants and do not justify a diagnosis of pathological maladjustment.

In final summary, relative adequacy of psychological adjustment in normal infants cannot be accurately determined by the same physiological and psychological measurements which have become useful in studying specific aspects of functioning in abnormal infants.

Microfilm \$2.75; Xerox \$4.40. 82 pages.

PSYCHOLOGY, EXPERIMENTAL

"FATE" REVISITED

(L. C. Card No. Mic 60-6532)

Jean M. Barnes, Ph.D.
Northwestern University, 1960

Supervisor: Dr. Benton J. Underwood

The present experiment is concerned with the "fate" of first-list associations as determined by immediate written free recall in four transfer paradigms: A-B, A-C (stimuli identical; responses different); A-B, A-Br (stimuli and responses identical but re-paired in the second list); A-B, C-B (stimuli different; responses identical); A-B, C-D (stimuli and responses both different). The lists consisted of eight paired-associates with nonsense syllables as stimuli and adjectives as responses. The first list was learned to a criterion of one perfect trial. A 1-min. rest interval separated first- and second-list learning. Subjects were stopped after 15 anticipation trials on List 2 and were given immediate written free recall in which they were instructed to write first-list responses after the appropriate first-list stimuli which were presented on a mimeographed recall sheet. Subjects were allowed two minutes for written recall. Half of the Ss in each transfer condition were given a list of the responses learned in List 1 and were instructed to pair them with first-list stimuli. These Ss formed the list-recall subgroups of the four transfer paradigms. The remaining Ss in each transfer condition formed the free-recall subgroups. The two conditions of recall in the four transfer paradigms form eight independent groups of 24 Ss each. In addition, a control group of 24 Ss was run as a check on normal forgetting. All Ss received a "free association" task following written recall in an attempt to determine the extent or generality of the loss of first-list responses from S's repertoire produced by factors

operating in the transfer paradigms during second-list learning.

Theoretically, three factors were identified as involved in the production of RI in immediate written free recall of the four transfer paradigms: (1) extinction of first-list S-R or forward associative connections; (2) extinction of first-list R-S or backward associations; and (3) extinction in response-recall, i.e., extinction of associative connections formed between environmental or contextual stimuli and first-list responses. The first and third factors were hypothesized as operating in the A-B, A-C paradigm. The first and second factors were hypothesized as operating in the A-B, A-Br paradigm. The A-B, C-B and A-B, C-D paradigms were included for independent verification of factors (2) and (3), respectively. Any one or a combination of these three factors might produce decrements in free-recall. Hence, RI was predicted for the free-recall subgroups of all four transfer paradigms. In list-recall however, the effect of the third factor is presumably eliminated. Thus, RI was predicted in list-recall for all but the A-B, C-D condition. These predictions were verified. In addition, results verified all the hypotheses concerning extinction-like factors operating during second-list learning in the four transfer paradigms.

The results would seem to indicate that paired-associate recall may be divided into two stages: a response-recall phase and an association phase. A loss in recall apparently may occur in one phase independent of loss in the other phase. Loss in recall in the associative phase may be produced by factors (1) and/or (2) listed above. Losses in response-recall were attributed to factor (3). Results in the free association task were inconclusive as to the generality of response loss.

Microfilm \$2.75; Xerox \$5.40. 109 pages.

THE PERFORMANCE OF EDUCABLE MENTALLY HANDICAPPED AND INTELLECTUALLY NORMAL CHILDREN ON SELECTED TASKS INVOLVING SIMPLE MOTOR PERFORMANCE

(L. C. Card No. Mic 61-497)

James Duane Beaber, Ed.D.
Syracuse University, 1960

A survey of textbooks revealed two differing generalizations with respect to level of motor performance of the mentally retarded. This study compares the simple motor performance of a group of retarded children with the performance of two groups of normal children. The retarded group was equated with one group of normal children on the basis of chronological age and to the other on the basis of mental age.

Three groups of 30 subjects equally divided as to sex were selected from regular and special classes within the New York State Public Schools. The groups were designated as the Educable Mentally Handicapped (EMH), Young Normal (YN), and Older Normal (ON) subjects. The range and means of the distributions for mental age (MA), chronological age (CA), and intelligence quotient (IQ), for each of the three groups are contained in Table 1. The 1937 Revised Stanford Binet Scale, Form L was used to determine

TABLE 1
STATUS OF THE THREE GROUPS ON
CHRONOLOGICAL AGE, MENTAL AGE AND
INTELLIGENCE QUOTIENT

Group	Intelligence Quotient		Chronological Age (Months)		Mental Age (Months)	
	Range	\bar{X}	Range	\bar{X}	Range	\bar{X}
EMH	61-73	66.68	166-189	177.7	104-124	114.1
YN	90-109	99.47	104-124	115.1	104-125	114.3
ON	90-110	100.76	166-189	180.3	158-196	173.2

MA and IQ. Differences between sex within the three groups on the variables of CA, MA, and IQ, between the YN and EMH groups as to MA, between the ON and EMH groups as to CA, between the ON and YN groups as to IQ were not significant.

Four tests on simple motor performance were administered individually to the subjects. The Simple Response Time (SRT) test required the subject to move the preferred hand from a starting point to a switch 10 inches away in response to a white light. The median time of 6 responses was recorded as a trial score. Six trials were recorded. The Rate of Tapping (RT) test measured the least number of taps recorded from one of two positions spaced 8 inches apart during a 10 second trial period. Five trials were recorded. The Rate of Manipulation (RM) test measured the number of seconds required to turn 20 one-inch diameter pegs with squared bottoms a half turn in two horizontal rows on the form board. Five trials were recorded. The Choice Response Time (CRT) test required the subject to move the preferred hand from a starting point to one of two switches controlling either a red or a green light, each located 10 inches away. A random presentation of the red and green stimulus lights was used. The median time of six responses was recorded as a trial score. Six trials were recorded.

Comparisons of the performance of the EMH and YN groups and between the EMH and ON groups were made for each of the four tests. A trend analysis indicated that the performance curves for each of the three groups on each of the four tests were parallel and that there were no significant differences among trials. Comparisons between total performance means for the EMH and YN groups indicated no significant differences on the four tests. Differences were observed between the performances of the EMH and ON groups on each of the four tests. Observation of the data indicated that the ON group performance was consistently superior to that of the EMH group. There appeared to be a trend for the ON boys to be superior in their performance to that of the ON girls. However, no significant differences between sexes were observed within each of the three groups.

The results of this study indicate that intellectually normal children and educable mentally retarded children of similar chronological ages differ in simple motor performance as tested by the four selected tests. Where the simple motor performance of intellectually normal children was compared with the performance of educable mentally handicapped children of similar mental age, no differences were observed.

The consistency of the results using four tests of simple motor performance is of particular interest; however, the

limited number of tasks used imposes severe limitations toward the evolution of any generalized hypothesis. The results do suggest the advisability of continued investigation toward this end.

Microfilm \$2.75; Xerox \$7.40. 158 pages.

THE RELATION OF EXPERIMENTER STATUS AND ACHIEVEMENT IMAGERY TO THE CONDITIONING OF VERBAL BEHAVIOR

(L. C. Card No. Mic 61-87)

Herbert Blaufarb, Ph.D.
University of Illinois, 1960

A number of studies have demonstrated the efficacy of a variety of verbal reinforcers in modifying verbal behavior, presumably without the subjects' awareness. However, other studies, using the same reinforcers, have failed to demonstrate verbal conditioning. These inconsistent results suggested that factors, other than verbal reinforcement, were operating in the verbal conditioning situation. Among the factors receiving attention have been interpersonal and intrapersonal factors.

The main purpose of this study was to discover whether the interpersonal variable of E status and the intrapersonal variable of S achievement orientation were related to the effect of verbal reinforcement on verbal behavior. It was hypothesized that: (1) Ss conditioned by high status Es will show a greater degree of learning than will Ss conditioned by low status Es; and (2) Ss high in achievement orientation will show a greater degree of learning than will Ss low in achievement orientation. A significant interaction between status and achievement orientation was looked for, but not strongly expected.

In view of recent evidence of the importance of the S's awareness in verbal conditioning, the S's reported hypotheses and intentions were also examined.

The 24-picture form of the Iowa Picture Interpretation Test (IPIT) was given to 271 Ss. The test was a measure of achievement orientation. One hundred and twenty Ss, 57 with high achievement imagery scores and 63 with low achievement imagery scores, were chosen to be run in the conditioning task. The conditioning sessions were conducted by five high status Es and five low status Es. Status was defined by age, expertness, and educational rank. Each E served eight Ss each, four high in achievement orientation and four low in achievement orientation. To control for the possibility that the frequency of report of the critical response class would increase spontaneously across the blocks apart from the influence of the reinforcement, two verbal content categories were reinforced. One group of verbs pertained to "verbal activity," and the other denoted "bodily activity." One "verbal activity" verb and one "bodily activity" verb were paired in unique combinations on the stimulus cards. Half of the Ss were reinforced on one category, and the remaining Ss were reinforced on the other category. The reinforcement was "Mm-hmm," voiced in an approving manner.

Immediately after the conditioning session each S was questioned concerning his awareness. S's replies were used as a basis for rating him on three verbal report variables: "behavioral hypotheses" (S's report of what he was

supposed to say in the conditioning session), "reinforcement hypotheses" (S's report of the significance of the contingent stimulus), and "intentions" (S's report of what he intended to say in the conditioning session). These variables were then related to S's performance.

The experimental results failed to support the hypotheses. Neither E status nor achievement orientation were related to performance. The status x achievement orientation interaction effect was also insignificant.

A verbal conditioning effect was not demonstrated. Examination of the verbal report variables showed that "behavioral hypotheses" and "intentions" were related to performance. Analysis also showed that "reinforcement hypotheses" were not related to performance, but were related to "behavioral hypotheses." These results emphasize the importance of cognitive and volitional factors in mediating performance in a verbal conditioning situation. They also argue against an automatic strengthening role for the reinforcer, and in favor of a signal function.

Microfilm \$2.75; Xerox \$6.80. 141 pages.

EMOTIONALITY AND LEARNING ABILITY OF PROGENY FROM ADRENAL DEMEDULLATED AND NORMAL MICE SUBJECTED TO CHRONIC PRENATAL STRESS

(L. C. Card No. Mic 60-6145)

Donald Frost Caldwell, Ph.D.
Vanderbilt University, 1960

Supervisor: Professor G. W. Meier

Recent research has demonstrated that both epinephrine and norepinephrine when perfused into the blood stream of a gravid, placental mammal have a deleterious effect on the fetuses (Dornhorst & Young, 1952). Furthermore, the experimenters felt that the mechanisms whereby these hormones were capable of exerting their action on the fetuses was through the constriction of the placental vasculature with a resulting decrease in the reciprocal exchange through this structure. In view of these findings and their explanation, the present investigator reasoned that adrenal medullary epinephrine and norepinephrine might represent one of the principle constituents leading to the fetal damage which is the consequence of stress administered to the placental mammal during gestation. The feasibility of this supposition was further enhanced by the realization that the medullary hormones are present in all placental mammals (although not in the same proportions), and, furthermore, that these hormones are generally secreted in excessive amounts to a variety of noxious stimuli.

Carworth Farms #1 mice were utilized as subjects in this investigation. All animals were randomly assigned to one of six experimental conditions in a 2 x 3 factorial design. One treatment dimension consisted of three levels of control for the hormonal variable: (1) an adrenal demedullated, (2) a sham-demedullated, and (3) a non-operative group. The second treatment dimension was concerned with the presence or absence of stress during gestation for all subjects. Half of the animals from each of the three surgical groups were randomly selected to receive a stressor at three daily intervals throughout their

period of gestation. Stress was accomplished by the blockage of a conditioned avoidance response learned prior to mating by all animals. The decision to train all subjects on the avoidance task was based on an intent to eliminate the possibility of creating an unfavorable environment for prenatal growth prior to mating in the stress group mothers. During the stress sessions only the CS was presented. The rationale for the choice of this stressor rested on several considerations: (1) the demonstrated ability of a fear anxiety response to cause the secretion of both of the adrenal medullary hormones, (2) the need for a stressor which would not directly cause damage to the fetuses, and (3) the use of a method highly resistant to extinction. Since some degree of handling was necessary for the administration of the stressor, no-stress animals were handled in the same manner and at the same periods as the stress group subjects. In this manner all subjects were equated for the handling variable and, therefore, for any possible direct damage done to the fetuses as a result of such handling.

The mothers from all experimental groups were administered "relearning" trials following the post-operative recovery period in order to assess the effects of the surgery on the previously trained avoidance response. An analysis of the relearning data revealed that the adrenal demedullated mothers required a significantly larger number of trials to meet the performance criterion. Since differences between experimental groups existed only during early relearning trials and, furthermore, since all subjects attained the performance criterion, the results from this analysis were not interpreted as indicating a differential degree of fear to the CS for the three stress groups.

Indexes of the importance of the medullary hormones in prenatal stress consisted of measures of both weight and number of mortalities at birth and at the time of weaning for all litters. Moreover, measures of the degree of emotionality and learning deficit were obtained for a sample of one male and female from each of the litters of the six experimental conditions.

The results of all analyses indicated that the experimental groups did not differ significantly for either the biometric or psychometric measures. The absence of differences between the non-operative groups for the stress and no-stress treatment dimensions was interpreted as a possible indication that handling during the period of gestation had imposed a stress on all the mothers. Thus, it was believed that the no-stress groups had served as a replication of those groups originally designed as part of the stress treatment. Since the three operative treatments within each of the two stress dimensions did not differ between themselves for any of the criteria measures, it was concluded that the importance of the adrenal medullary hormones in stressor action on parental development and postnatal behavior had not been demonstrated in this investigation. Microfilm \$2.75; Xerox \$5.60. 114 pages.

SOME EFFECTS OF ALTERING AMOUNT AND TYPE OF REINFORCEMENT ON OPERANT BEHAVIOR OF PRESCHOOL CHILDREN

(L. C. Card No. Mic 60-6979)

B. J. Campbell, Ph.D.
The University of North Carolina, 1960

Supervisor: Dr. E. R. Long

The operant behavior of approximately 30 preschool children was studied in an attempt to determine some effects of altering amount or type of reinforcement. Subjects included boys and girls four and five years old. They attended a local nursery school and participated on a volunteer basis. The response reinforced and recorded was lever pulling. Subjects were reinforced with plastic and metal trinkets such as seen in chewing gum machines and with small plastic cars. The schedules of reinforcement included Fixed Ratio schedules taking on values up to 100 responses per reinforcement, Fixed Interval schedules up to 1.5 minutes per reinforcement, and Variable Interval schedules up to an average of one minute per reinforcement. The children worked alone in cubicles and all manipulations of reinforcement, schedule, and discriminative stimuli were accomplished by the experimenter from another room.

The cumulative response records of children were similar to those generated by lower organisms and reported by Ferster and Skinner in Schedules of Reinforcement, but generally lacked the stability found by these investigators. It was found that alteration of amount or type of reinforcement produced rate increases and/or better schedule control in some of the subjects. Changing from trinkets to cars seemed more often to produce behavioral changes than did changing from one to two trinkets. Changes in response rate and/or schedule control attributable to the probes seemed more often to occur among boys than among girls. The effectiveness of altering amount or type of reinforcement as a means of producing behavioral changes decreased with repeated exposure. It was also found that play activities or special instructions prior to experimental sessions had little effect on the selected operant response. Presence of an experimenter in the cubicle, however, seemed to suppress rate in proportion to response strength.

Microfilm \$2.75; Xerox \$6.80. 144 pages.

A TEST OF GRADUAL VERSUS ONE TRIAL THEORIES OF LEARNING OF PAIRED ASSOCIATES

(L. C. Card No. Mic 60-6441)

Archie B. Carran, Ph.D.
University of Cincinnati, 1960

In a series of studies Rock has presented evidence from which it might be concluded that the initial formation of paired associates occurs at full strength in one trial. Rock's two basic procedures were to retain all pairs on subsequent trials for one group, but to substitute new pairs

for missed ones in another, the substitution group. The writer suspected that Rock's results are only a special case which might be included within a theory of gradual learning.

An analysis, based partly on Hull's theory, was used to provide information about the possible relationships of sH_R , sI_R , and the number of repetitions of practice to the probability of correct recall. Deductions were derived from three assumptions:

- (1) F_a (F_b) is a constant such that $F_a - F_{a s_j} H_{R_j}$ ($F_b - F_{b s_j} I_{R_j}$) is the immediate increment to sH_R (sI_R) due to the $j+1$ pairing of a stimulus and response item.
- (2) $1 > F_a > F_b > 0$.
- (3) The probability of initial recall is an increasing monotonic function of the algebraic magnitude of sH_R minus sI_R .

It was deduced that relatively small F_a and F_b tend to increase the probability of initial recall with the second practice whereas larger values may actually decrease it.

An indirect approach wherein missed pairs were repeated once only in both a transformed substitution, S , and repetition, NS , procedure was adopted. It was assumed that pairing the stimulus item of a missed pair with a different response item on succeeding trials might cause decrease in the probability of recall of a missed pair, if it was submarginally acquired, before it is eventually practiced a second time under the S procedure. The absence of such inhibition under an NS procedure wherein missed pairs are presented on the immediately following trial may tend to allow for more efficient learning of missed pairs than does the S procedure. Decay of sH_R at a rate equal to or greater than that of sI_R should produce a similar effect. The crucial point is that the above effects cannot occur, and both procedures are equally efficient, *ceteris paribus*, unless some fractional increment to sH_R and sI_R did occur with the practice of the missed pair.

Operations were selected in an attempt to provide for superior learning of once missed pairs under the NS procedure rather than insignificant results or superior S procedure learning. It was hypothesized that for previously unpracticed paired associates the number of pairs missed twice for two NS sessions would differ from the number of pairs missed twice for two S sessions.

Data was obtained from 24 students run over two NS and two S sessions in counterbalanced order. The procedure was such that rehearsal and overlearning were minimized.

In support of the hypothesis considerably fewer pairs were missed twice under the NS procedure ($p < .001$). On the basis of the results it is concluded that a practice, which is insufficient for recall of a paired associate item, increases the probability of correct recall after an additional practice.

The present assumptions predict that the likelihood of demonstrating an increase in the probability of correct recall is greater when sH_R increments are relatively small. Other things equal, the relative magnitude of sH_R increments for different learning materials could be inferred from their probability of recall with one practice. An *a posteriori* attempt to exhibit a probability of correct

recall, with an immediately following second practice of missed pairs, which would be appreciably higher than the probability of correct recall with only one practice was successful ($p = .01$). In agreement with the present assumption, a difficult category of items showed this effect whereas the items as a whole did not. Since collection of the data, an article demonstrating decrease in probability of recall, using different learning operations, has appeared. This is also in agreement with the present assumptions but was misinterpreted, it is believed, in view of the present study, as support for one trial learning theory. Microfilm \$2.75; Xerox \$4.00. 72 pages.

VERBAL CONDITIONING: EXPERIMENTAL EXTINCTION AS A FUNCTION OF THE POSITION OF A SINGLE REINFORCEMENT.

(L. C. Card No. Mic 60-6762)

Ray Albert Craddick, Ph.D.
Washington University, 1960

Chairman: Abel G. Ossorio

This study investigated the effects of a single reinforcement upon resistance of habit strength to extinction. It has hypothesized that these effects were a function of the placement of intermittent reinforcement following a period of continuous reinforcement. That is to say, intermittent reinforcement increased the difficulty of discriminating the period of training from that of extinction.

The S s said all words that came to mind, and were given reinforcement for all verbs emitted. After approximately 15 minutes of continuous reinforcement, a single reinforcement was introduced under conditions of either 1:1, 1:5 or 1:10 Fixed Ratio schedules. This was followed by a three-minute rest period. Half of the S s in each schedule were given one reinforcement for the first verb emitted after the rest period. All S s were given 6 minutes of extinction.

Statistical analysis indicated no significant differences existing between any of the groups in terms of initial (pre-training) verb emission frequencies, or number of reinforcements obtained during training. Significant differences however were found which indicated resistance to extinction is primarily a function of the degree of non-reinforcement which S has experienced prior to extinction. Groups given the 1:10 schedule performed at a significantly higher level in extinction than did groups given the 1:5 ration. The 1:5 groups also performed at a higher level than did groups experiencing only continuous reinforcement prior to extinction. The reinforcement given immediately prior to extinction had no effect in and of itself, on resistance of habit strength to extinction.

The conclusion from the study was that in verbal conditioning, resistance to extinction is a function of S 's inability to differentiate extinction from training. When administered after a period of non-reinforcement, a single reinforcement can function adequately to reduce discrimination, and consequently increase resistance to extinction. The degree of resistance is a factor of the number of non-reinforced trials preceding the one reinforcement

Significance of the findings suggests that further research using verbal conditioning techniques may be useful in the investigation of problematic areas in clinical psychology.

Microfilm \$2.75; Xerox \$3.80. 69 pages.

AN INVESTIGATION OF THE DRINKING BEHAVIOR OF THE WHITE RAT

(L. C. Card No. Mic 61-294)

Richard Kelly Davenport, Jr., Ph.D.
University of Kentucky, 1956

Director: Dr. Ernest Meyers

This research was undertaken to describe the drinking behavior of the white rat and to relate the characteristics of the drinking responses of the rat to various levels of drive strength. Six adult male albino rats which served as subjects were allowed to drink in a special apparatus which permitted recordings of number of laps, rate of lapping, length of drafts, length of pauses, volume of water consumed, and volume of water taken at each lap. Contact of the rats tongue at each lap with the water receptacle activated a cumulative impulse counter and a signal marker which marked a wax paper recording device. The current passing through the rat at each lap was less than one microampere. This did not affect the drinking behavior. Two drinking tubes were employed, one with a 19 sq. mm. opening, the other with an 8 sq. mm. opening. Three levels of drive were used: 6 hour, 18 hour, and 36 hour deprivations. Each rat served for five consecutive trials under each of the six combinations of experimental conditions: large tube, 6 hour deprivation; large tube, 18 hour deprivation; large tube, 36 hour deprivation; small tube, 6 hour deprivation; small tube, 18 hour deprivation; and small tube, 36 hour deprivation. The order of experimental conditions for each rat was different from every other rat.

Analyses of variance were performed on the data. The mean lapping rate of these six animals under all conditions was approximately six laps per second. There was no significant difference in rate between the periods of deprivation or sizes of tubes, nor did the rate change significantly with continued drinking. The rate at the end of a drinking period is no different from the rate at the beginning. The rate of lapping is an extremely constant figure which appears not to vary with experimental conditions. The rank order correlation coefficient between tongue size and rate of lapping was -.50.

The lengths of successive drafts and pauses within a drinking period were calculated. The length of the successive drafts becomes shorter and the length of successive pauses becomes longer during a drinking period. Several theories which would account for this phenomenon were discussed.

The volume of water consumed in a drinking period was related to the degree of deprivation preceding the test. As expected, the rats drank more after having been deprived for greater lengths of time than for lesser lengths of time. The volume of water taken per lap was not different between hours of deprivation and did not change significantly with practice. The volume of water per lap taken from the large tube was significantly greater than

from the small. The tongues of the rats were removed and the top surface area measured. The relation between the area measurement and volume per lap was very low.

The major conclusions were:

1. The lapping rate of the rat does not vary with hours of deprivation, size of drinking receptacle or with continued exercise of the response.
2. The lengths of the succeeding drafts progressively decrease.
3. The length of the succeeding pauses progressively increases.
4. The rat does not become more efficient in lapping (efficiency is defined in terms of volume per lap) with continued practice.
5. New theories of thirst and its cessation are necessary to explain the pattern of drafts and pauses.

Microfilm \$2.75; Xerox \$4.00. 73 pages.

BRIGHTNESS DISCRIMINATIONS WITH CONSTANT DURATION INTERMITTENT FLASHES

(L. C. Card No. Mic 61-248)

Robert Lewis Erdmann, Ph.D.
Columbia University, 1960

This study was performed to determine the probability of detection of constant duration intermittent flashes as a function of flash frequency with flash luminance and background luminance as parameters.

The subjects were adapted to a 14°30' field of constant luminance and presented with a 1° test flash train in the center of the field. The duration of the stimulus train of flashes was one second. Twenty observations were gathered on two practiced subjects for each of nine frequencies ranging from 1 to 20 flashes per second.

The results indicate: (1) increasing flash luminance increases the probability of detection for every condition, (2) for the condition of low background luminance, probability of detection increases as flash frequency increases and (3) for the higher background luminances, the initial increase in probability of detection is followed by a systematic decrease at frequencies of 15 and 20 flashes per second.

The increase in the number of chances for flash detection with increasing flash frequency may account for the initial increase in probability of detection that occurs for all luminance values.

The decreases in detection probability for the higher flash frequencies at the higher background luminance levels can possibly be attributed to a period of diminished sensitivity that is dependent upon the time interval between flashes. The failure to observe this effect at the lowest background luminance can possibly be attributed to a difference in critical duration.

Microfilm \$2.75; Xerox \$3.00. 32 pages.

THE EFFECTS OF SENSORY
DEPRIVATION ON INTELLECTUAL
EFFICIENCY AS A FUNCTION
OF PERSONALITY

(L. C. Card No. Mic 60-5523)

Ira Goldberg, Ph.D.
The University of Oklahoma, 1961

Major Professor: Alfred F. Glixman

Previous studies have not been able to demonstrate conclusively the presence of intellectual impairment in individuals who have been exposed to sensory deprivation.

The purpose of this study was to investigate the effects of sensory deprivation on intellectual efficiency as a function of personality.

A line of reasoning was presented which led to the conclusion that basic personality characteristics should be crucially related to the type of regression which occurs when contact with the external environment is drastically reduced. The Rorschach and Figure-Drawing Tests were used to measure these personality characteristics.

The specific purposes of this study were to test the predictions that there is a relationship between:

1. Adequacy of introspective-coping skills and attitudes toward the self (as indicated by Rorschach and Figure-Drawing scores) and the degree of intellectual efficiency (as measured by a series of intellectual tasks).
2. Adequacy of introspective-coping skills and attitudes toward the self and adaptation to sensory deprivation (as measured by a rating scale).
3. Degree of adaptation to sensory deprivation and the degree of intellectual efficiency.

Subjects were 16 junior and senior medical students at the University of Oklahoma School of Medicine. The eight most adequate copers and the eight least adequate copers were divided equally and at random into experimental and control groups. Both groups received pre- and post-administrations of equated intellectual tasks. Between the two administrations, the experimental subjects were placed in a sensory deprivation chamber. Control subjects relaxed under moderate stimulation between the two administrations.

The scores on the intellectual tasks were submitted to an analysis of variance which indicated that none of the effects were significant. Therefore, the prediction that personality test scores would be positively related to intellectual efficiency was not supported by the evidence.

A positive relationship was found between the personality test scores and adaptation to sensory deprivation. Individuals who demonstrated poor coping- introspective skills and negative self-attitudes, demonstrated poorer adjustment to sensory deprivation.

No relationship was found between the degree of adaptation to sensory deprivation and the degree of intellectual efficiency on post-deprivation tests.

On the basis of results in this study, it was concluded that while personality appears to be related to deprivation adjustment, there is no evidence to support the view that personality is related to intellectual impairment which results from sensory deprivation. Possible reasons for these results were discussed, and suggestions for future research were offered.

Microfilm \$2.75; Xerox \$6.80. 141 pages.

AN EXPERIMENTALLY INDUCED
APPROACH-AVOIDANCE CONFLICT AND
THE MEASUREMENT OF ELICITED
FEAR BY AN OPERANT RESPONSE

(L. C. Card No. Mic 61-40)

Michael Hanek, Ph.D.
The Pennsylvania State University, 1960

An attempt was made to investigate the Dollard and Miller approach-avoidance conflict model in the realm of higher mental processes. An operant response ratio was used as a measure of elicited fear. Sixteen hypnotized Ss were individually given a post-hypnotic suggestion that they would feel afraid upon the presentation of a cue and that a small light flash would momentarily diminish the fear. Amnesia was instructed for the suggestions. Standard operant response equipment was used and Ss were conditioned to press a switch to activate a small light. Each S's responding rate during a variable interval reinforcement schedule was used as a base rate of his responding.

Ss were again hypnotized and an experience was suggested to have actually occurred to them. They were further instructed that they would feel, upon awakening, that it would be very important to think (approach) about the suggested experience but that they would feel either very afraid or mildly afraid (avoid) whenever they were reminded, in any way, of the terminal event in the suggested experience. It was also suggested that a small light flash would eliminate their fear as long as it occurred. After the Ss were awakened, a tape recording was played to them which contained an Introductory paragraph, the suggested experience divided into three paragraphs, and a paragraph containing an unrelated event. All five paragraphs were equal length in word count and presentation time. Ss were randomly assigned to one of two levels of suggested fear and to one of the four rotated orders of paragraph presentation. As Ss listened to the tape recording, the frequency of operant responses in the presence of the several stimulus paragraphs was recorded. The observed frequency for each stimulus paragraph was compared with each S's own base rate to obtain a ratio of operant responding.

Eight un hypnotized control Ss were instructed to act as if they felt afraid for the conditioning period and to act as if the recited experience had occurred to them. Operant response ratios were also computed for their performances.

Separate factorial analyses of variance were computed for the experimental and control groups to evaluate three comparisons under investigation. The comparisons were: 1) intensity of elicited fear as a function of the two levels of experimentally induced and acted fear; 2) intensity of elicited fear as a function of "distance" from the feared goal topic; and 3) generalization of elicited fear to the unrelated event as a function of induced drive strength.

Factorial analyses of variance of the operant response ratios in the presence of the three crucial stimulus paragraphs revealed, for the experimental groups, a significant effect at the .05 level of significance due to the stimulus paragraphs but no significant effect due to the levels of induced fear nor to the interaction effect. When the operant response ratios of the experimental groups in the presence of the three crucial stimulus paragraphs plus the unrelated event were compared with a factorial analysis of variance, no significant effects were found for the levels of induced fear, for the paragraphs, nor for the interaction. No

significant effects were found for any of the comparisons in the control groups.

Ss were requested to rank the four stimulus paragraphs in terms of which one made them feel most to least afraid. Rankings by the control groups revealed no significant trend. Rankings by both experimental groups revealed significant trends beyond the .05 level of significance. Strongest fear was reported in the presence of the paragraph containing the feared event and weakest fear was reported in the presence of the paragraph containing the unrelated event. Intermediate intensities of fear were reported in the presence of the two stimulus paragraphs leading to the feared event.

It was concluded that the significant effect due to the increase in operant response ratios as a function of the three crucial stimulus paragraphs and the significant rankings of felt fear obtained from the experimental Ss lends support to the Dollard and Miller contention that elicited fear increases with nearness to a feared goal, and that conflict in the realm of higher mental processes follows the same laws as conflict in simple spatial situations.

Microfilm \$2.75; Xerox \$4.80. 91 pages.

SECONDARY REINFORCEMENT IN A TWO-CHOICE SITUATION

(L. C. Card No. Mic 60-6295)

Gilbert Roland Johns, Ph.D.
Indiana University, 1960

Since the experimental routines in a symmetric two-choice prediction situation have been extensively analyzed and have produced consistent results, they can be used to study the effects of a secondary reinforcer in human learning. In the two-choice situation, subjects predict which of two reinforcing lights, E_1 or E_2 , will occur after a signal by making the corresponding response, A_1 or A_2 . The situation was modified so that a neutral event (a tone not mentioned in the instructions) was paired with a reinforcing event during conditioning. Then during extinction, the neutral event was presented in place of the reinforcing event. The extent of secondary reinforcement effects were analyzed when (a) a tone was paired with E_1 or E_2 during conditioning (Study I), and (b) two easily discriminable tones were paired with the two reinforcers (Studies II and III).

In Study I, 160 subjects received 120 conditioning trials during which the probability of E_1 was .75. The three pairing procedures were: tone paired with E_1 , tone paired with E_2 , and no tone at all. During 200 extinction trials, the tone was presented with a probability of 1.00, .75, and .25 for both the tone- E_1 and the tone- E_2 groups. Control groups received tone probabilities of zero and 1.00. Thus, for example, a tone paired with E_1 (during conditioning) should act as a secondary reinforcer of the A_1 response when E_1 and E_2 no longer occur (during extinction). If the tone terminates .25 of the extinction trials, A_1 responding should decrease from the conditioning terminal level of .75.

For the 64 subjects in Study II, $Tone_1$ and E_1 were presented jointly with a probability of .75, $Tone_2$ and E_2 with a joint probability of .25. During extinction $Tone_1$ and $Tone_2$ were presented to four groups with respective

probabilities of 1.00 and zero, .75 and .25, .25 and .75, and zero and 1.00.

In Study III, $Tone_1$ and E_1 , as well as $Tone_2$ and E_2 , were presented with a joint probability of .50 to 32 subjects. During extinction $Tone_1$ and $Tone_2$ occurred with probabilities of .70 and .30 for one group, and .85 and .15 for another.

Analysis was made of the number of A_1 responses throughout conditioning and extinction. In addition, A_1 -responding at the end of extinction was compared with tone probability during extinction.

The following conclusions were made:

1. Pairing of a distinctive tone with each of the reinforcing events, or pairing a tone with but one of the reinforcing events, had no appreciable effect on prediction behavior during conditioning.

2. The tone, or tones, were seen to produce appropriate secondary reinforcing effects during subsequent extinction, and tone schedules during extinction influenced A_1 -responding.

3. In both the one- and two-tone situation, the secondary reinforcing effect was weakest when tone probabilities were zero or 1.00. A tentative explanation for this effect was offered in terms of the lessening of the cue effects of the tone(s) resulting from the lack of opportunity for discrimination during extinction.

4. In both of the tone situations, when tone probabilities were not changed from conditioning to extinction, subjects gave A_1 -proportions which matched the tone probabilities during extinction.

5. When tone probabilities were changed from conditioning to extinction, two effects occurred:

(a) In the one-tone situation, response frequency, while clearly influenced by tone schedule during extinction, did not match that schedule.

(b) In the two-tone situation, response frequency tended to match tone schedule during extinction in every case except those mentioned in statement 3, above.

Microfilm \$2.75; Xerox \$4.40. 84 pages.

PLEASURE CENTERS IN THE BRAIN?

(L. C. Card No. Mic 60-6229)

Don Robert Justesen, Ph.D.
University of Utah, 1960

Chairman: Lyle E. Bourne, Jr.

Theoretical

In 1954, Olds & Milner reported that rats had maintained stable lever-responding to focal, electrical stimulation of the subcortical brain. Later, other Es extensively confirmed this electrical self-stimulation of the brain (ESB) in rats, cats, and monkeys. Of the many attempts to explain ESB that have appeared in the neuropsychological literature, by far the most interesting and potentially significant is Olds' "parasympathetic pleasure-center" theory. According to Olds, ESB occurs because the electrical brain stimulus activates parasympathetic reward systems normally activated when Ss eat, drink, or copulate. The possibility that the theory may advance understanding of

normal hedonic processes is dimmed somewhat, however, by its lack of generality and predictive success. While lack of generality may be less a criticism than an indication that more than one mechanism may give rise to ESB, the failure of the theory to account for many of the findings from which it was derived rather militates against its validity. At the neurophysiological level, e.g., many of Olds' findings suggest that sympathetic, much more than parasympathetic, activities participate in the production of ESB. And at the behavioral level, other studies reported or cited by Olds indicate that ESB is accompanied by: aversive behaviors, absence of responding during extinction, failure of spontaneous recovery, and the necessity of *Es* to stimulate *Ss* before "voluntary" ESB responding commences. Thus, far from suggesting positive reinforcement via activation of "pleasure centers," the above findings invite comparison with aversively conditioned habits, i.e., *Ss* may be responding to the brain stimulus, not for some purely rewarding affect, but because once responding has commenced, it "hurts" to stop responding. It is suggested in the present paper that such a negative reinforcement, analgesic mechanism does occur, and because the onset of the ESB stimulus transiently masks, blocks, or otherwise reduces painful sequelae of previous stimulations. The assumption that an analgesic mechanism does subserve ESB leads to predictions, moreover, that comport especially well with most ESB findings. But unlike Olds' "parasympathetic pleasure-center" theory, the analgesic mechanism in nowise presupposes normal neuroanatomical functioning of the brain structures associated with ESB.

Experimental

Although many investigators have reported instrumental ESB in the cat, such ESB has invariably been preceded by training schedules which first reinforced the operant response with food, then food and brain stimulation combined, before reinforcing with brain stimulation alone. The possibility that the brain stimulus may have functioned in ESB as a secondary reinforcer thus raises a rather interesting question: will the instrumentally naive cat also respond reliably to the electrical brain stimulus?

The answer provided by the presently reported study is a highly qualified "yes." During several half-hour testing sessions, seven cats responded reliably above operant levels to one-half second trains of caudate stimulation-treadle-pressing rates in excess of 1000 responses an hour were observed. However, other findings led to the conclusion that the ESB observed was not based upon primary reinforcement:

1. Operant treadle-pressing rates were highly correlated with the ESB treadle-pressing rates throughout several sessions (mean product-moment $r = .90$), suggesting that the brain stimulus merely increased behavioral activity and thus, simply accelerated in a uniform manner the emission rate of each *S's* operant.

2. Brain stimulation measures were followed by no noticeable resistance to extinction; subsequent milk-reinforced responses, however, yielded considerable resistance to extinction.

3. Typical acquisition and extinction curves were not observed in conjunction with brain stimulation measures, but were observed in conjunction with milk-reinforced training.

4. Following milk-reinforced training, mean response rates to the same parameters of brain stimulation failed to differ from operant levels. Apparently, the high rates of treadle-pressing engendered by that training led to such initially rapid ESB responding that electrophysiological disruption of the treadle-pressing "trace" occurred in several *Ss*, preventing further intra-session responding. The *Ss* would respond rapidly early in each session, and then, before extinguishing, display ineffectual, treadle-pressing-like movements against the empty milk-delivery tray or against the floor area adjacent to the treadle.

5. Following milk-reinforced training, but not before, an anomalous form of treadle-pressing to the brain stimulus was observed in a few *Ss* which was highly stereotyped and repetitive. Motion picture studies suggested forced-movement automatism, but the anomalous responding wouldn't occur unless *Ss* were food-deprived for a considerable length of time and shielded from distracting lights or noise. Microfilm \$2.75; Xerox \$4.00. 73 pages.

AN INVESTIGATION OF THE RELATIONSHIP BETWEEN CONCEPTUAL ABILITY AND SEMANTIC GENERALIZATION IN SCHIZOPHRENIA

(L. C. Card No. Mic 61-302)

Charles Henry Lynch, Ph.D.
University of Kentucky, 1956

Director: Dr. Graham B. Dimmick

Experimental investigation of semantic generalization is relatively new to psychology, but various theories about the phenomenon have been advanced. Among these is one by Razran. He has suggested that semantic generalization results from the subject's categorizing the generalization stimulus on some sort of similarity-dissimilarity scale. The purpose of this study was to seek empirical evidence for this interpretation.

Since anxiety is a major variable involved in stimulus generalization, a measure of this factor was obtained, and the further hypotheses were advanced that anxiety should increase the level of conditioning and that it should also increase the degree of semantic generalization.

Thirty-six schizophrenic patients were used as subjects. The use of this type of subject was desirable since a greater range of performance could be expected which would facilitate the evaluation of the results.

Two tests of conceptual ability and a rating scale of anxiety were obtained on each subject after the subjects had been equated for their pre-morbid level of intellectual ability.

The galvanic skin response of the subjects was then conditioned to one of two conditioned stimulus words. One of these words had a household connotation, and the other had a rural connotation. Each conditioned stimulus word had a set of eight generalization words, and all the words were contained in the same list. It was hypothesized that those subjects who demonstrated a high level of conceptual ability would also demonstrate a high level of semantic generalization and that those who demonstrated a low conceptual ability would demonstrate a low degree of semantic generalization.

The experiment was designed to permit a 2 x 2 analysis of covariance by varying conceptual ability and the conditioned stimulus in two ways. The effects of anxiety could then be removed by means of the covariance technique.

It was found that the high and low conceptual groups had conditioned at significantly different levels. Therefore, the data was adjusted for this difference in level of conditioning as well as for differences in level of anxiety. The results of this multiple regression covariance analysis indicated that a significant difference did exist between the degrees of semantic generalization demonstrated by the high and low conceptual groups. Thus the hypothesis of the relationship of conceptual ability and semantic generalization advanced by Razran was supported.

Statistical tests of the data were made to determine the effects of anxiety on conditioning and generalization after the subjects had been redistributed into high and low anxiety groups.

It was found that anxiety does cause a significant increase in the level of conditioning. The investigation for differences in level of generalization proved to be not significant. However, the results of the analysis of covariance for the differences in generalization level did suggest a trend in this direction.

The findings of a significant relationship between conceptual ability and semantic generalization also supports the theoretical positions of Hull and Osgood. The finding suggests the possibility of reducing the concepts to some common set of variables within the theoretical frameworks of these two men which could then be investigated experimentally.

Microfilm \$2.75; Xerox \$5.60. 112 pages.

SOME EXPERIMENTS ON STIMULUS CLASSIFICATION WITH IMPLICATIONS FOR PERSONALITY THEORY

(L. C. Card No. Mic 60-6304)

Albert Rudolph Marston, Ph.D.
Indiana University, 1960

A theoretical framework was presented for the investigation of classification as a construct in the understanding of stimulus equivalence. The approach was taken that stimulus equivalence, an individually defined lawfulness of the environment, provides a useful set of variables in the study of personality. The series of experiments described were related to postulates concerning the consistency of discrete stimulus classes and their relationship to responses. Also, an attempt was made to distinguish a discrete stimulus class hypothesis from a generalization gradient hypothesis.

The first experiment in this series tested the postulate that responses associated with one member of a class will come to be associated with similar probability to all members of that class. Subjects were trained to classify a set of geometric figures and to associate a response to one member of each of the two training classes. They were then presented the entire set of stimuli and asked to respond with one of the two training nonsense syllables. With repeated presentation of the set, response proportions for each subject on each stimulus were tabulated. Rules based

on the stated postulate and the nature of the stimuli in question were used to predict the particular classification trained. This prediction was not significantly successful for the total group of subjects. There were significant differences in the training and prediction rates between the group trained on the basis of shape and the group trained on the basis of number. These differences led to the hypothesis that taking pre-experimental classification preferences into account would allow for successful demonstration of the consistency of classification and of the stated response postulate.

Experiment II tested the hypothesis by administering a classification preference step prior to the procedure used in Experiment I. It was found that the prediction success was significantly greater in those groups trained on their preferred classification than in those trained on their non-preferred classification. With long-term stimulus classification taken into account, consistency of classification was demonstrated by utilizing the proposition stating that members of a class elicit the same response with similar probabilities.

Experiment III, using complex social stimuli, examined the postulate that individuals use a consistent stimulus classification which can be inferred from their observable behavior. Subjects were asked to classify ten stimuli in three ways: (a) by sorting them into groups, (b) by comparing various trios of the stimuli, and (c) by using nonsense syllables associated with two of the stimuli to respond to all ten. Hypotheses testing intra-individual consistency in classifying the same stimuli in different ways were all supported. It was found, as in the previous experiments, that a response associated with one member of a class is elicited significantly more frequently by other class members than by stimuli outside the class. It was also found that the appearance of a generalization gradient extending over all the stimuli tested seemed to be a function of averaging step-like curves for individual subjects who used discrete classes with varying but sharp boundary lines.

Microfilm \$2.75; Xerox \$3.80. 67 pages.

A STUDY OF SECONDARY SENSATIONS ARISING IN EMOTIONALLY LOADED SITUATIONS

(L. C. Card No. Mic 60-6143)

Russell Ellsworth Mason, Ph.D.
Purdue University, 1952

Major Professor: Dr. L. M. Baker

Three experimental studies of internal (organic) sensations, as observed during emotionally-toned situations, are reported. The first was an exploratory study wherein several types of associations were recorded with the internal sensation observations and all areas of the body were observed for the relative occurrence of such sensations. The second was a pilot study employing standard stimuli for group administration and limiting the observations to 10 body areas. The third study incorporated these features and involved 139 patients and 176 non-patients for internal sensation observations and 94 non-patients for feeling reaction ratings of the same stimuli used for the internal sensation observations.

With motion picture scenes having different feeling loadings in Study III, 95.1 per cent of the subjects reported some internal sensations.

Patterns of internal sensations reported differed at less than the .1 per cent level for the 10 different areas of the body studied.

Patterns of internal sensations reported were found significantly different at less than the .1 per cent level of confidence for the experimental situations which employed different feeling loadings.

For the 10 anatomical areas studied and with the different feeling loadings involved in Study III, non-patient subjects reported greatest internal sensation in the center chest area, the right midriff area, the lower abdomen area, and they reported least sensation in the calf area. The remaining areas studied were also sub-divided by significant differences in ratings. Common types of sensations reported included "tightness," "tingling," "chills," "palpitation," "warmth," "sickness," "hollow," and "pressure or heavy."

Of the patient groups, 22 of the 25 neuropsychiatric and psychosomatic diagnostic types and sub-types differed in mean sensation ratings at less than the 1 per cent level of probability from the non-patients.

Patterns of internal sensations in different body areas with different feeling reactions for these studies were reported.

The implications of these findings for psychology as a basic science were discussed.

Microfilm \$2.75; Xerox \$5.00. 97 pages.

THE RELATIONSHIPS AMONG BODILY ACTIVITY, THE AUTOKINETIC EFFECT, REVERSIBLE FIGURES, AND VISUAL FIGURAL AFTEREFFECTS.

(L. C. Card No. Mic 60-3296)

Keith Gawain McKittrick, Ph.D.
University of Cincinnati, 1960

The present study was designed to test the hypothesis of an inverse relationship between bodily activity and performance on the following four perceptual tests:

(1) Fluctuating Cube, (2) Visual Figural Aftereffects, (3) Reversible Figure-ground, and (4) Autokinetic Effect.

A second hypothesis, that the above test scores were intercorrelated, was proposed. This followed from the possibility that the bodily activity factor might affect all tests similarly, and because of the further theoretical possibility of similar central factors being associated with each perceptual test.

The subjects in the experiment consisted of two groups of college students, 50 males and 50 females. A special flexible metal chair was connected directly with a kymograph recording device which allowed a continuous record of incidental bodily activity to be made during a 15 minute period. Within this time tests and retests were made with the above perceptual measures. Only the tests of Fluctuating Cube, Reversible Figure-ground, and Autokinetic Effect, (latency and duration of first phase of movement) were used, since they had acceptable reliabilities of .70 or above.

Linear correlation coefficients between the latter tests and the bodily movement measures in both groups were not significant and thus the hypothesis of an inverse relationship between bodily activity and perceptual test scores was not supported.

The second hypothesis, that of intercorrelations among the perceptual measures, was supported only between the Fluctuating Cube and Reversible Figure-ground in both groups. (Men $r = .54$; Women $r = .51$) In the male group two additional tests were correlated, that of Reversible Figure-ground and Autokinetic Movement, duration of first phase of movement. ($r = .25$)

Post hoc analysis revealed a significant curvilinear relationship between bodily movement and autokinetic latency in the female group. Women high and low in bodily activity tended to have longer autokinetic latencies, and women in the middle range of bodily activity had average or short autokinetic latencies. The males displayed significantly greater bodily activity than the females and the latter had longer latencies in perceiving autokinetic movement than did the males.

It was concluded that respect to the major hypothesis that, in order to demonstrate relationships between bodily and perceptual activity, it might be necessary to deal with groups showing wider or controlled behavioral variations using more refined and relevant measures. The results also suggested the existence of non-linear relationships in the area of individual differences in perception.

Microfilm \$2.75; Xerox \$3.80. 66 pages.

PATTERNS OF EXTINCTION FOLLOWING FRONTAL POLE LESIONS OF THE RAT BRAIN

(L. C. Card No. Mic 61-52)

Nancy Kishlar Mello, Ph.D.
The Pennsylvania State University, 1960

Assessment of the physiological basis of learning and extinction is a focal problem in neuropsychology as is the development of more precise and sensitive measures of behavioral change following neurological deficit. Despite the importance of extinction as a traditional measure of learning and the considerable psychological evidence suggesting that extinction and acquisition are not identical processes, the extinction process has been virtually ignored in neuropsychological research. If the retention and extinction of a simple motor response were differentially affected by experimental ablations, this would have potential value for the behavioral assessment of neurological damage as well as for the increased understanding of the neural substrata of learning.

This experiment was undertaken to determine if frontal pole lesions in the rat differentially affect post-operative response patterns in a lever-pressing situation. The lever-pressing operant was selected as a dependent variable because it is reliable, readily quantifiable and involves the same pattern of movement coordination as the non-visual tactile placing reaction which is mediated by the somatic-sensory motor cortex in the rat.

Observations were made on 63 male hooded rats, randomly assigned to one of two schedules: continuous

reinforcement of a fixed reinforcement ratio of 6:1; then trained to a criterion of 600 reinforcements over a period of 6 days. After completion of the training sequence, animals in each group were randomly assigned to experimental and control procedures and bilateral electrolytic lesions of the somatic-sensory motor cortex were produced in the experimental animals. Following a 48 hour recovery period, all animals received two 30 minute reinforcement sessions followed by two 30 minute extinction sessions and a series of alternate reinforcement and extinction sessions over a period of 10 days; yielding a total of five post-operative sessions under each condition.

An analysis of variance for repeated measures performed on the continuous reinforcement group yielded no differences for either reinforcement or extinction data. For the fixed ratio group, there were no significant differences between operated and control animals in the presence of reinforcement, however, the between group differences during extinction were significant at the .01 level of confidence. Graphic presentation of these data showed that during the first two extinction sessions, there was a typical abrupt decrease in the responding of both groups. However, during extinction sessions 3, 4, and 5, the fixed ratio experimental animals responded in a perseverative fashion and their average number of responses increased through time while the control animals maintained a low response level. The tendency of the experimental animals to persist in a stereotyped response in the absence of reinforcement may relate either to an inability to discriminate the two situations adequately or to a lowered capacity to respond flexibly to the altered stimulus conditions.

Finally the animals were sacrificed and their brains examined. Possibly because the lesions varied within such a small range, there did not appear to be any consistent relationship between amount of neocortex removed and responses to extinction.

The results of this experiment tentatively support the notion that once a response has been learned, the neural mechanisms subserving its performance may differ somewhat from those mediating its extinction. However, although frontal pole lesions do produce increases in extinction responding without affecting reinforced performance of a lever-pressing response, the effect may be specific to and in part determined by the schedule of reinforcement employed. This finding parallels data on the interaction of behavioral and pharmacological variables in which the reinforcement schedule appears to determine the nature and temporal course of the drug effects. Ratio schedules usually produce appreciably higher extinction functions than continuous reinforcement and in this instance, served to accentuate extinction performance differences between control and operated animals.

In conclusions, these data suggest that neuropsychological studies of learning should examine post-operative extinction patterns as well as retention and acquisition for an optimally sensitive reflection of the effects of experimental lesions. Certainly the clarification of the examination of many relevant behavioral parameters and attention has long been focused solely upon post-operative acquisition and retention of learned habits.

Microfilm \$2.75; Xerox \$6.80. 145 pages.

THE EFFECT OF THE DEGREE OF STIMULUS OVERLAP AND OF CHANGES IN IRRELEVANT CUES UPON DISCRIMINATION LEARNING AND REVERSAL

(L. C. Card No. Mic 60-6305)

Marilyn Evelyn Miller, Ph.D.
Indiana University, 1960

Two groups of 48 Ss each were run in a two-choice discrimination learning and reversal series, each group with a different degree of stimulus overlap between the two discriminative stimuli. At reversal, new overlapping cues were substituted for half of each group; for the other half, all the cues were the same on training and reversal. Throughout training and reversal (432 trials each), a test trial was given after every eighth regular trial.

The stimulus-component and no-overlap models, both derived from the Burke-Estes set-theoretical model for learning, were evaluated.

The results indicated that the asymptotic response level was not affected by the degree of overlap, and that the asymptotic level tended to equal the corresponding proportion of reinforcement. On the early trials of a series the overlapping portion of the stimulation apparently contributed to the response probabilities in accordance with the stimulus-component model, whereas with a relatively greater number of stimulus presentations, the response proportions were more in accordance with the predictions of the no-overlap model. It was suggested that the influence of the overlapping cues upon response probability decreased during learning and that the rate of decrease (or adaptation) was more rapid with the lesser degree of overlap. For a given degree of overlap, the rate of adaptation on reversal was more rapid when "unadapted" irrelevant cues were not substituted at reversal. Except with the lesser degree of overlap and following a relatively large number of stimulus presentations, the effect of reversal upon adaptation appeared to be a disruptive one.

The response proportions of the test trials were not adequately predicted by either of the two models.

Microfilm \$2.75; Xerox \$6.00. 124 pages.

A COMPARISON OF TWO LEARNING MODELS FOR TWO-CHOICE CONDITIONING EXPERIMENTS INVOLVING NONREINFORCED TRIALS

(L. C. Card No. Mic 60-6306)

Richard Bolster Millward, Ph.D.
Indiana University, 1960

A study was run to investigate the effects of nonreinforced trials on response probability in a two-choice contingent verbal conditioning experiment. In the experiment, subjects were asked to predict which of two lights, designated as the E_1 and E_2 events, would occur on each of a series of trials. On each trial following the prediction (designated as an A_i response for an E_i event), one of the two lights, or neither (designated as an E_0 event) would occur with a conditional probability, $n_{ij} = \Pr(E_j | A_i)$, $i = 1$,

2 and $j = 0, 1, 2$. The effects on the probability of an A_1 response on trial n , P_n , of varying the Π_{10} and Π_{20} values were studied by determining which of two hypotheses better described these effects. The two hypotheses were: (1) an identity hypothesis, i.e., that there would be no change in P_n on a trial on which an E_0 event occurred, and (2) a sharing hypothesis, i.e., that on a trial following a trial on which an E_0 event occurred, the probability of making the response made on the previous trial would change according to some sharing parameter, a , to be estimated from the data.

The two hypotheses were incorporated into linear models: the identity hypothesis into the linear model of statistical learning theory and the sharing hypothesis into a two-state Markov model. Although an exact asymptotic probability of an A_1 response could not be described in general for either model, upper and lower bounds on the asymptotic probability could be established for both models. Nonoverlapping bounds were established for the two models by a judicious selection of the reinforcement parameters, Π_{ij} . Thus, by observing asymptotic response proportions of A_1 responses made by subjects run under particular reinforcement parameters, a choice could be made between the two models and the associated hypotheses.

In the experiment, four groups of 24 subjects each were run. Each subject was run for 480 trials on an independently selected schedule of conditional reinforcement events. The four groups were differentiated on the bases of the Π_{10} and Π_{20} values and on the asymptotic bounds delimited by the two models.

The linear model with the identity assumption gave a clearly more adequate description of the asymptotic response proportions than did the patterning model with the sharing assumption. The data for statistical Monte Carlo subjects (homo-stats), run according to the linear-identity model and matched one to one to the humans by being run on the same conditional reinforcement sequences, agreed quite well with the data for humans, except for one group. The mean proportions of the humans and homo-stats in this group were brought into good agreement when two learning rate parameters were estimated from the human data and used to generate the learning curves for homo-stats.

However, for all groups, the humans were more variable in responding than the homo-stats. Improvement was made in the agreement of the variabilities when two learning rate parameters were used for generating the homo-stats. Nevertheless, asymptotically the human and homo-stat subjects remained significantly different in response variability. Microfilm \$2.75; Xerox \$5.40. 110 pages.

RESPONSES TO THE REINFORCING STIMULUS AS A VARIABLE IN LEARNING EXPERIMENTS

(L. C. Card No. Mic 60-6311)

Troy Edward Nunis, Jr., Ph.D.
Indiana University, 1960

The hypothesis underlying the present study is that the reinforcement process can profitably be investigated by examining responses made to reinforcing stimuli.

Accordingly, a number of reinforcement parameters were varied, and the concomitant variation in certain reinforcing responses was observed. These responses were analyzed in terms of the course of learning in a T-maze situation.

Independent variables were amount of reinforcement, nutritional value of reinforcement, probability of occurrence of the reinforcement under partial reinforcement conditions, and correction versus non-correction procedures.

Dependent variables were start box latencies, running times, and proportion of correct choices. The responses made to the reinforcing stimuli were another set of variables. These reinforcing responses were:

1. Number, rate, and distribution of eating responses
2. Time in the goal box
3. Latency from choice point response to first eating response

Two related experiments were conducted. In the first, three groups of rats were reinforced in a T-maze with a constant volume of saccharin solution. Concentration was varied to define a high, medium, and low concentration group. Each of these three groups was divided into two sub-groups on the basis of reinforcement contingency. One group was consistently reinforced for a given turn and never reinforced for the opposite turn. The other group was randomly reinforced on 75% of the trials for making one turn, and on 25% of the trials for making the other. A non-correction procedure was followed for 40 days at one trial a day.

In the second experiment a correction procedure was adopted for all subjects, and a bit of sucrose was added to the high and low concentrations. The intermediate group did not receive this additive so that the effects of the correction variable could be observed across the two experiments at this concentration. The dependent and reinforcing response variables were those mentioned above for both experiments.

For the regular reinforcement groups of experiment I, proportion of correct responses was the only dependent variable to show significant concentration effects, and the partial reinforcement groups showed no significant differences in any response attributable to concentration differences. Running times and start box latencies decreased over trials for all groups, but at essentially the same rate.

Upon examining reinforcing responses for the regular reinforcement groups of experiment I, two were found to co-vary with proportion of correct choices, rate of ingesting the reinforcing agent and latency from the choice point to the goal box. For the partial reinforcement groups, no systematic relationships were found.

The regular reinforcement groups of experiment II showed significant concentration effects in proportion of correct responses only. Other measures reflected learning during the experiment, but no significant differences existed between groups. The partial reinforcement groups showed no evidence of learning with respect to choices in the maze. Running times and start box latencies decreased, but did not show significant concentration effects.

The addition of a nutritive agent and a change to a correction procedure did not result in any significant changes in responding.

For the regular reinforcement groups of both experiments, there was a significant concordance of ranking of reinforcement concentration by proportion of correct choices, rate of ingestion, and choice point-goal box latency measures. Microfilm \$2.75; Xerox \$3.00. 53 pages.

BRAIN LESIONS AND CONDITIONING IN THE RAT

(L. C. Card No. Mic 61-304)

Lelon James Peacock, Ph.D.
University of Kentucky, 1956

Director: Dr. J. S. Calvin

The ablation method, which consists of determining the effects of central nervous system lesions upon various kinds of behavior, has been applied to many different learning tasks. Probably because of the difficulty of establishing classical conditioning in the albino rat, the method has not been applied to this animal.

The present study was designed to investigate the effects of cortical ablations upon classical and instrumental conditioned responses. Twenty male albino rats with lesions ranging from 2.6% to 25% of the total neopallium were compared on bar-pressing behavior and on a conditioned general motor reaction with seven normal animals and seven surgical controls. It was found that brain-injured and normal animals behaved essentially the same way in the Skinner-box situation, although animals with larger lesions differed significantly from animals with smaller lesions. A possible explanation of this result, which is not incompatible with earlier ablation studies on manipulatory responses, was offered in terms of a differential level of activity of the two groups as influenced by frontal lesions.

It was found that the classical conditioning task (a general motor reaction conditioned to the onset of a light) served to discriminate the operated from the normal animals, but only when the histologically defined somesthetic and/or motor areas of the cortex were injured. The validity of this interpretation depends upon the correctness of Fortuyn's cortical areas. No evidence for a mass action principle was found, within the limits of the rather small lesions produced.

The results were discussed in terms of their possible bearing on the controversy about the existence of one or several kinds of learning. It was concluded from the obtained results that on the neural level at least there seem to be at least two different kinds of learning.

Microfilm \$2.75; Xerox \$3.00. 53 pages.

A TEST OF TWO ALTERNATIVE HYPOTHESES OF THE ASSOCIATIONS THAT DEVELOP IN SERIAL VERBAL LEARNING

(L. C. Card No. Mic 60-6577)

Robert James Rehula, Ph.D.
Northwestern University, 1960

Director: Benton J. Underwood

Two alternative hypotheses were proposed as explanations of the associations that develop in learning a serial list of verbal items. The hypothesis that items become associated to their serial positions was called the serial-position hypothesis (SPH). The hypothesis that items become associated to adjacent items was called the

serial-item hypothesis (SIH). It was reasoned that if the SPH was true, shifting the original list (after some learning had occurred) in such a way that items appear in different serial positions but still appear in the same serial order, performance should be disrupted since new serial-position associations would have to be developed. But if the SIH was true such a shift should not disrupt performance to any great degree since the serial-item associations developed in original learning would still be relevant.

The major test of the two hypotheses was made by comparing the performance of Ss under one of three transfer conditions after having learned the original list to a pre-determined degree of learning. The three conditions were as follows: (1) the original list (OL) condition -- Ss continued learning the same list, (2) shifted list (SL) condition -- Ss learned a list in which the items were in the same serial order as in the OL but appeared in different serial positions, (3) random list (RL) condition -- Ss learned a list composed of the same items as in the OL but in a new random order. The OL condition represented no disruption of either serial-position or serial-item associations, whereas the RL condition represented disruption of both serial-position and serial-item associations. It was assumed that if the SPH were true, Ss in the SL condition would perform like Ss in the RL condition since both conditions represent a change in the serial position of all items learned in original learning, therefore requiring learning of associations between items and their new serial positions. But if the SIH were true, Ss in the SL condition should perform like Ss in the OL condition since both conditions represent very little or no disruption of serial-item associations developed in original learning. The Ss in the SL condition demonstrated a great ability to transfer associations learned in original learning to the SL. Since performance of Ss in the SL condition was similar to Ss in the OL condition, and quite different from Ss in the RL condition the SIH was favored over the SPH.

A second variable manipulated was the type of list originally learned. Two OLs were used, each containing 13 two-letter items. The Intra-item list was constructed so that associative strengths were strong between letters of items and weak between the last letter and first letter of successive items. The Inter-item list was constructed so that associative strengths were the reverse of those in the Intra-item list. The Intra-item list was used to facilitate response-learning and Inter-item list was used to facilitate serial-item association. The lists did not produce a difference in over-all learning but did produce differences in response-learning and associative-learning.

A third variable manipulated was the degree of original learning. The Ss learned one of the OLs to a criterion of 6/13 or 12/13 before going to one of the three transfer conditions. For Ss taken to a criterion of 6/13, there was no difference in the transfer condition as a function of the OL learned. At the 12/13 level of learning, Ss that learned the Inter-item list performed significantly better in the SL condition than Ss that learned the Intra-item list.

Some discussion was given to this final result and results obtained in another study which did not appear to support the SIH. Implications of the independent manipulation of response-learning and associative-learning were also discussed. Microfilm \$2.75; Xerox \$4.60. 87 pages.

ELICITATION OF IMITATIVE RESPONSES IN A VERBAL CONDITIONING EXPERIMENT

(L. C. Card No. Mic 60-6329)

Georgia Windman Spreen, Ph.D.
Indiana University, 1960

The purpose of this study was to investigate the imitation of a class of verbal responses in a verbal conditioning experiment. Considering imitation a learned response unit, and the event of another's response-and-reinforcement a probable important cue in the social learning of imitation of verbal responses, it was predicted that such imitation would be elicited when this cue was presented in a verbal conditioning setting. Two major hypotheses were tested:

1. When two subjects are presented with a verbal conditioning task together, one subject being regularly reinforced for a class of verbal responses and the other never reinforced, the nonreinforced subject will increase his use of the class of words reinforced for his partner.
2. When two subjects, similarly presented with a verbal conditioning task together, are reinforced for mutually exclusive response classes, the acquisition of the response class for which the subject is directly reinforced will be retarded by his imitation of the class of response for which his partner is reinforced.

Subsidiary hypotheses predicted no difference between men and women in the amount of conditioning or imitation obtained.

Sixty pairs of subjects, 30 of men and 30 of women, were presented with 3" x 5" cards on which four pronouns and two verbs, one in the past and one in the present tense, appeared. The subjects were required to construct a sentence for each card, using one of the pronouns and one of the verbs as the first two words in the sentence. In 40 of the subject pairs, one subject was reinforced for every use of a certain verb class, past or present, the other was never reinforced. In the remaining 20 pairs, the subjects of a given pair were reinforced for different verb classes.

The data were analyzed by means of Alexander's test for trend. When the data from subjects who were able to verbalize the contingency between their responses and the reinforcement were eliminated, the following major results were obtained:

1. Nonreinforced subjects did not increase in their use of the class of words for which their partner was reinforced.
2. Subjects conditioned in the presence of a nonreinforced partner showed a significant increase in the class of words reinforced. However, when the data were separated according to sex of the subject, the women showed a significant trend, the men did not. This difference between men and women was highly significant.
3. Subjects conditioned in the presence of a partner who was reinforced for a different class of responses did not increase in their use of the class of responses for which they were directly reinforced. When only the data of the women were considered, the difference

between this group and the group reinforced in the presence of a nonreinforced partner was significant.

These results indicate that imitation of verbal responses, in the restricted response-selection task used in this study, occurs only when the imitator has himself obtained some reinforcement. It was suggested that a highly important factor in the elicitation of imitation of non-judgment verbal responses may be the imitator's perception of the experimenter as a source of reinforcement. Microfilm \$2.75; Xerox \$5.20. 102 pages.

THE RELATIONSHIP BETWEEN DEPRIVATION WEIGHT LOSS AND TWO ACTIVITY MEASURES

(L. C. Card No. Mic 61-71)

F. Robert Treichler, Ph.D.
The Pennsylvania State University, 1960

This study attempted to investigate the effects of some methodological procedures which have been shown to influence the relationship between deprivation and measures of activity in the rat. The effects of different kinds and intensities of deprivation were noted when animals were measured in two different activity devices.

Sixty male rats were deprived of food, water, or the combination of food and water and their daily weight losses were recorded. All weights were expressed as a per cent of the predeprivation weight adjusted for normal gain. Activity was measured for three days prior to deprivation in running wheels or stabilimetric cages. Activity scores under deprivation were expressed as a per cent of this base rate measure. Ten animals under each condition of measurement and deprivation were continuously deprived until they died or reached 55% of their adjusted predeprivation weight. Daily records of activity and weight were maintained and plotted graphically. Interpolated activity scores at each 5% body weight point were used in the analysis of the data.

Nonparametric analyses comparing activity as a function of kinds of deprivation were computed. Similar comparisons of activity in the two devices as a function of deprivation intensity were also made. Weight losses during the first four days were compared for effects due to measurement or deprivation conditions. These same conditions were compared in their effect on survival to 55% body weight. The following conclusions were made:

1. The kind of deprivation has little differential effect on subsequent wheel or stabilimeter activity if deprivation intensity is equated by a body weight deficit criterion.
2. Large differences between activity scores in wheels and stabilimeters are noted when deprivation conditions are imposed. Wheels yield marked advances while stabilimetric activity shows comparatively little change.
3. No apparent differences in weight on the first four days of deprivation result from maintaining the animals in different devices or on different kinds of deprivation.
4. The different kinds of deprivation do have an effect on the weight level to which an animal can be reduced. The removal of food seemed to constitute a more severe condition than water deprivation.

5. Caging in running wheels induced death at higher weight levels than caging in stabilimeters, possibly because of the increased energy expenditure associated with deprivation in wheels.

Microfilm \$2.75; Xerox \$3.60. 64 pages.

TIME VS. INTENSITY IN SOUND LOCALIZATION

(L. C. Card No. Mic 60-6638)

Randolph Howard Whitworth, Ph.D.
The University of Texas, 1960

Supervisor: Dr. Lloyd A. Jeffress

This study presents data on five subjects who adjusted a delay-line until a 500 cps tone (the pointer), supplied by earphones, matched in phenomenal location another 500 cps tone (the signal). The two tones were presented alternately. Various combinations of interaural time and intensity differences for the signal tone were used.

Some subjects were able, after a period of practice, to respond at will to either of two sound images which they perceived. One sound image had interaural time differences as the primary cue, while the other image's localization was based on intensity, as well as time cues.

The "time" response data closely resemble the data of previous studies in which very small time-intensity equivalences were obtained. The "intensity" responses resemble in many respect (but not all) the data obtained by previous investigators which showed substantial time-intensity relations.

The results of this experiment are not adequately explainable in terms of a simple peripheral time-intensity trading relation. It appears that since subjects were able to respond to time differences in one way and to intensity differences in another, the localization apparatus is being presented with both time and intensity information and is capable of discriminating between them.

Microfilm \$2.75; Xerox \$3.00. 54 pages.

PROBLEM SOLVING AND SEARCH BEHAVIOR UNDER NONCONTINGENT REWARDS

(L. C. Card No. Mic 60-6756)

John Cook Wright, Ph.D.
Stanford University, 1960

The relative frequency of reward, rather than the particular response rewarded, is proposed as a determinant of search behavior during problem solving. Noncontingent reward is presented as an arrangement in which the

proportion of trials to be rewarded in a pseudo-concept-formation task is predetermined by E; the sequence of rewarded and unrewarded trials is randomized; and solutions, if any, are invented by S. The problem is to determine the effects of reward density upon the statistical uncertainty of a sequence of responses and upon the complexity of those rules or hypotheses which generate the internal redundancy of the response sequence.

In Experiment I, subjects pressed buttons, one at a time, from a circular array of sixteen buttons. Rate of response was ignored. Ss were rewarded by a buzz and a point on a visible, cumulative point counter in accordance with a controlled mean reward density and a predetermined random sequence in each block of 25 trials. Five groups of sixteen Ss each were run with various probabilities of reward, constant in some groups, and changing steadily over successive blocks in others. Each response was recorded automatically, and each block of 25 consecutive responses was scored for the degree to which the sequence formed an internally consistent pattern. This score, called response uncertainty, has a maximum of 25, indicating a random response chain, and a minimum of 1, indicating perfect convergence upon an internally consistent response rule. The special scoring scheme devised for this purpose is presented in detail. A second score, derived in part from the first, indicates the average complexity of the hypotheses tested, weighted by their frequency of use. Both scores are derived directly from the responses themselves, and require no judgments or verbal interaction with S.

Response uncertainty was a curvilinear function of the probability of reward, with a maximum at .50, an intermediate value at .00, and a minimum at 1.00. Both the linear and quadratic trends were significant. Complexity was maximum when the probability of reward was .50, and was symmetrical about that value (quadratic trend significant).

In Experiment II, five additional groups of sixteen Ss each performed on the same apparatus, but with the following changes: The point counter was concealed, a tone sounded in place of the buzz on each trial where a buzz was not pre-programmed, and Ss were instructed simply to learn how to control the two outcomes by the selection of buttons, so that subsequently they could produce either sound at will. As before, the outcome schedule was predetermined and was independent of the particular responses made.

Response uncertainty in Experiment II was a symmetrical, curvilinear function of the probability of occurrence of one of the two mutually exclusive and exhaustive outcomes. It was least at .50, greater at high and low values. Complexity, however, was greatest when the two outcomes were equally likely (.50), and declined at high and low values. In both cases only the quadratic trends were significant, as predicted.

The following conclusions are drawn and discussed:

1. Exhaustive, algorithmic search replaces heuristic and insightful search when the probability of reward is sufficiently low.
2. When information-seeking replaces reward-seeking as the task, uncertainty of response is

negatively related to the statistical uncertainty of outcome.

3. Complexity of instrumental hypotheses is greatest when a period of high reward follows a period of low reward, or when the occurrence of a reward is least predictable.
4. Complexity of information-seeking search strategies is a positive function of uncertainty of outcome.

New research problems in this area are suggested.
Microfilm \$2.75; Xerox \$5.00. 98 pages.

TIMING BEHAVIOR IN RATS AS A FUNCTION OF SOME TEMPORAL VARIABLES

(L. C. Card No. Mic 61-432)

Joseph Zimmerman, Ph.D.
University of Maryland, 1960

Supervisor: Dr. Joseph V. Brady

This report describes several experiments which examine the relationship between rate of reinforcement and the timing behavior of rats. These experiments utilized two schedules of reinforcement which controlled the consequences of timing behavior in terms of the rate of reinforcement variable.

The schedules of reinforcement employed were spaced responding procedures in which rats were reinforced for responding only after a specified delay period. The

procedures were programmed in discrete trials initiated by the presentation of a discriminative stimulus (SD) and were terminated by either a response (R) or by the time out of a clock, whichever occurred first. Either event terminated the SD. Responses which were emitted after a minimum period of time following the onset of the SD, but before the time out of the clock, produced a milk reinforcement. In one of these procedures, a recycling schedule, a trial was always begun six seconds after the emission of a response or six seconds after the time out of the clock. In the other procedure, a fixed trial schedule, a trial was always begun 36 seconds after the onset of the previous trial.

In the recycling schedule, subjects maximized frequency of reinforcement by responding consistently in the minimum SD-R interval that was reinforced. In the fixed trial schedule, differential response spacing in the interval of time over which reinforcement was available did not affect frequency of reinforcement.

Timing behavior maintained by the two different procedures was compared in three experiments. In two of these experiments, the recycling schedule maintained behavior which generated temporal distributions of responses which were more peaked and shifted towards shorter time intervals than distributions generated by the fixed trial schedules. These results were predicted on the assumption that rate of reinforcement would play a significant role in the control of timing behavior. In the third experiment, designed to control for miscellaneous variables other than frequency of reinforcement, the differences between the two schedules associated with the rate of reinforcement factor were eliminated. In this experiment, differences between the timing behavior maintained by the two procedures were insignificant.

On the basis of these observations, it was concluded that frequency of reinforcement played a significant role in the control of the observed timing behavior.

Microfilm \$2.75; Xerox \$5.80. 117 pages.

RELIGION

BIBLICAL INTERPRETATION AND HISTORICAL METHOD: AN ANALYSIS OF THE WRITINGS OF C. H. DODD, H. H. FARMER, AND ALAN RICHARDSON.

(L. C. Card No. Mic 60-6149)

Harold Horace Hinderliter, Ph.D.
Vanderbilt University, 1960

Supervisor: Professor Gordon D. Kaufman

The purpose of this study is to analyze critically the conception of history and historical knowledge with which these English writers interpret the biblical history, and specifically to consider the extent to which they have dealt with and resolved the problems arising from the application of the nineteenth century historical critical method (historicism) to biblical history. Because of the rise of historicism, the historical question has become basic in contemporary discussions of biblical interpretation. Historicism was fashioned under the influence of the natural sciences with the result that history was defined as factual occurrences external to the historian, and historical study became the "objective" recovery of "what happened." Further, the nature of what occurred was limited by the canons of natural science, such as the idea of a fixed causal order. This constituted a prejudice against any event which implied a divine intervention in biblical history. This method resulted in the separation of revelation from history.

The English writers, in keeping with much contemporary theology, have again taken seriously the idea that the Christian faith is historical, that is, is based on certain events in which God has acted to reveal Himself to man. Therefore, they have attempted to redefine the nature of history in a way that will make it possible to speak meaningfully of an historical revelation. Essentially, their view is that history is a combination of occurrence and meaning, that is, history involves the minds active in historical events. Thus, the study of biblical history includes a consideration of both the events and the meaning which they had for the Old and New Testament communities. Further, within this framework the nature of revelation in historical events is understood as a combination of historical occurrence and the meaning perceived by the prophetic mind active in the event. The study of biblical history discloses a pattern in the development of this history which is the substance of revelation in history.

An examination of this position reveals, however, that it has not fully overcome the limitations of historicism. There is a tendency to treat "factual occurrences" as more solidly historical than the meaning of the events, and also to assume that occurrence and meaning can be traced out with the same objectivity as historicism assumed possible in its study of the "facts" of biblical history. Further, there are indications that this view is not completely

successful in maintaining the historical character of revelation.

The underlying problem in this view is the failure to develop fully the distinctive character of the historical category and the tendency to work under the positivistic bias of historicism. The point of view of this thesis is that an adequate method of dealing with biblical history requires a re-examination of the historical category. Specifically, it requires recognition of the fact that man himself is the subject-matter of history, that his knowledge of history is itself an historical event and is thus historically conditioned.

It is argued that such a view provides a basis for understanding God's action as an historical event and at the same time as an event which can be known only as it enters into and modifies one's present existence. This makes it possible to maintain that if revelation is historical, it is accessible by means of historical knowledge and is, at the same time, apprehended only through faith.

Finally, the historical character of man's thinking is applied to man's knowledge of nature. The thesis is developed that nature is dependent upon history and knowledge of nature is historical knowledge. The implications of this position are worked out in relation to the problem of the miracles and the resurrection, which are crucial points in one's historical method.

Microfilm \$3.20; Xerox \$11.25. 247 pages.

CONFLICT SPIRIT-DUALISM IN THE QUMRAN WRITINGS AND IN THE NEW TESTAMENT

(L. C. Card No. Mic 60-6770)

Allen Leroy Irwin, Ph.D.
The Hartford Seminary Foundation, 1960

Is there any correspondence between the conflict dualism of the Qumran writings and that of the New Testament? Within the Qumran writings a type of conflict dualism, closely linked to the term and concept "spirit," comes to expression in a series of major variations and provides a persistent and unifying theme. The same conflict spirit-dualism, including its major variations is found constituting a significant and formative theme in the New Testament.

Part One of this study deals with spirit-dualism in the published non-canonical Qumran writings, including the Damascus Document. Part Two carries the investigation into the New Testament. An appendix provides an exhaustive list of occurrences of $\pi\iota\tau$ in the Scrolls, classified under more than a dozen semantic shadings.

The Two-Spirit theology of the Little Theological Treatise (1 QS iii 13 - iv 26) is not, as frequently supposed, the dominant pneumatology of the writings; rather, several

varieties of pneumatology appear. Four major variations of conflict spirit-dualism are found in the Scrolls, not mutually isolated, but interrelated and sharing common elements.

(1) Cosmic-metaphysical dualism appears principally in the Little Theological Treatise.

(2) A dualism of the "in-group" versus the "out-group," labelled "community dualism," pervades the Scrolls and comes to graphic expression in the Manual of Discipline (excluding the Little Theological Treatise).

(3) Eschatological dualism is most obvious in the War Scroll.

(4) A dualism of inner experience is found in the Qumran Book of Hymns. The natural self of man is weak and base. Through God's grace a new self is given, cleansing and establishing life. This new personal spirit is closely related to the Holy Spirit of God, yet not semantically identical. Man's natural base self is not, however, associated with Belial or the Spirit of Perversity. This variation is labelled "soteriological spirit-dualism."

In Part Two, these same variations of conflict dualism are pointed out in the New Testament, recognizable in parallelism of terminology and similarity of concept. Here, they are interwoven with and modified by a more basic theme: God's act in Christ, Christ's continuing presence, his expected eschatological victory. With this qualification, the fundamental variations of the Qumran writings are found to constitute also the major variations of conflict spirit-dualism in the New Testament.

Cosmic-metaphysical dualism is not found in pure conceptual form in the New Testament, but numerous parallels in terminology are demonstrable; with the reservation that Jesus, in place of the Prince of Light, occupies the positive side of the dualistic pattern, close similarities in concept appear as well.

Community dualism is widely represented in New Testament terminology and is apparent also in the concept of the unique relation between Spirit and Community.

Eschatological spirit-dualism is clearly visible in the New Testament, particularly in the book of Revelation.

Most striking are the parallels between the soteriological spirit-dualism of the Qumran Hymns and the conception of the indwelling Spirit in the writings of Paul.

Certain opinions concerning the question of direct contact between the Qumran Community and the Christian Community as well as suggestions concerning the early development of Christian pneumatology are tentatively presented, based on this study. The primary purpose of the work, however, is to demonstrate the presence of the same major variations of conflict spirit-dualism in the Qumran writings and the New Testament.

Microfilm \$3.85; Xerox \$13.50. 297 pages.

A STUDY OF SOME RECENT ROMAN CATHOLIC AND PROTESTANT THOUGHT ON THE RELATION OF SCRIPTURE AND TRADITION

(L. C. Card No. Mic 60-6524)

José Míguez-Bonino, Th.D.
Union Theological Seminary, 1960

The study purports to investigate the notion of tradition as it is discussed and defined in recent RC theology and to confront it with recent Protestant discussions of the theme.

A historical introduction (Chapter I) shows that the idea of tradition as a series of doctrines not contained in Scripture, predominant in post-tridentine RC theology is receding, under the pressure of modern developments in philosophy and theology, in favor of a more dynamic view of tradition as the very life of the Church under the direction of the Holy Spirit.

The tendency to rethink the idea of tradition has led some contemporary RC theologians to re-study and re-interpret the tridentine canon on Scriptures and traditions, indicating that it does not define authoritatively a partitive view of the transmission of "the truth of the Gospel," (partly in the Scriptures and partly in non-written traditions) but that it simply indicates "two channels" by which the one truth of the gospel comes to us, without defining the relation between them (chapter II). RC studies of the N.T. find that the apostolic message, as the living witness to the crucified and risen Lord, which in the power of the Holy Spirit places man in the fellowship of Jesus Christ, has found an integral embodiment both in the apostolic writings and in the living community -- with its proper hierarchy ministry -- which the Apostles left. There is only one salutary truth, Jesus Christ himself in the apostolic witness, and it is transmitted to us in the apostolic writings (the Scriptures) within the apostolic community (the Church). (Chapter III).

The tradition is, therefore, primarily, the exercise by the Church, through the proper channels given in its God-Appointed structure, of the commission given by Christ, to proclaim and explain authoritatively the apostolic doctrine. In the exercise of this function, the assistance of the Holy Spirit ensures the correct interpretation: the Church enjoys dogmatic infallibility. The Church does not add to the Scriptures but, in virtue of its personal fellowship with the reality of Jesus Christ, of whom the Scripture witnesses, it offers a progressive and developing understanding of the meaning of Scripture. (Chapters III and IV).

Protestant thought tends to recognize the importance of tradition as the matrix of Scripture and the co-inherence of Scripture and Church. (Chapter V). But even when re-interpretation both in RCatholicism and Protestantism is removing some of the obstacles to understanding, Protestant theology still feels that the RC understanding of the relation of Scripture and tradition, and behind it, of Christ and the Church, is theologically unacceptable. It dissolves the objectivity of the original apostolic witness by equating the authority of Scripture and interpretation (Chapter VI) and it thereby tends to destroy the confrontation of Christ and the Church, failing to recognize the full meaning of Christ's Lordship over the Church in grace and judgment. The Church claims for itself a right to pronounce God's

Word by itself and on its own right, which can only belong to it in a penultimate and subordinate way (Chapter VII). Finally, the outline of a Protestant view of the relation discussed is presented, trying to understand the function of tradition in reference to the dialectic of Christ-in-the-Church and Christ-over-the-Church, emphasizing both the Church's authority to proclaim God's Word and the Church's subordination to that Word as it finds its original witness in the apostolic message and doctrine.

Microfilm \$5.40; Xerox \$19.15. 421 pages.

THE PLACE OF GALATIANS IN THE CAREER OF PAUL

(L. C. Card No. Mic 61-260)

Howard Lyn Ramsey, Ph.D.
Columbia University, 1960

This study is a historical investigation of the major events of the career of Paul. Its twofold purpose is to provide a plausible chronology of the apostle's ministry and to establish the date of the Letter to the Galatians.

After the tentative establishment of the date of Paul's conversion at A.D. 37, a chronological reconstruction based primarily upon the apostle's letters is proposed. In part, it is as follows:

Paul's first visit to Jerusalem	A.D. 40
His labors in Syria, Cilicia, and Galatia	40-41
His European mission	42-54
The Jerusalem conference	54
His Ephesian ministry	54-56
His imprisonment in Caesarea	56-58

On this reconstruction some problematic passages in Paul's letters assume intelligible meaning. The vision of "fourteen years ago" (II Cor. 12:2-5) is identified with the Troas vision of Acts 16:9-10. Paul's labors in Macedonia "in the beginning of the gospel" (Phil. 4:15) are ascribed to a date early in his career. In I Thess. 2:14-16 allusions are found to the Herodian persecution and the Judean famine as events of the recent past. The Jerusalem

conference having been assigned to the Acts 18:22 position, Paul's activity in gathering the collection for the Jerusalem poor is ascribed to the two-year period immediately following the Jerusalem leaders' request in this connection (Gal. 2:10). Moreover, the sequence of events in the proposed reconstruction is substantially that to which Acts 15:40-28:31 attests. Finally, this chronology comports as well as any other with extra-canonical testimony concerning the dates of such events as the Judean famine, the death of Herod Agrippa I, the procuratorship of Felix, and the accession of Festus.

It will be objected that this reconstruction involves the dismissal of portions of Acts 9:1-15:39. The answer given is that these chapters constitute their author's "Great Preface" to Paul's career. Attempting, in part, to demonstrate that Pauline universalism was consistent with, and sanctioned by, Jerusalem Christianity, the author allowed his apologetic concerns to abrogate historical considerations. Against those who would assign the Jerusalem conference (Gal. 2:1-10) to the Acts 11:30 or Acts 15 position and thus reckon the events of Acts 9-15 to have covered fourteen to seventeen years, it is contended that the author of Acts intended to represent these events as having transpired between A.D. 37 and 44. The postulation of a decade of "silent years" between Paul's first (Gal. 1:18-19) and second (Gal. 2:1-10) Jerusalem visits distorts the witness both of the letters and of Acts. It is concluded that the usually proposed reconstructions of Paul's career rest upon unsound attempts to harmonize Gal. 1:11-2:14 with Acts 9-15.

The problem of the date of Galatians is viewed within the framework thus provided. The South Galatian theory of the location of the churches is maintained on the suppositions that (1) Paul endorsed the circumcision of Timothy (Acts 16:1-3) on his first visit to Galatia and (2) the Galatian churches participated in the offering for the Jerusalem poor (Acts 20:4). Shortly after the Jerusalem conference, Paul again visited the Galatian churches (Acts 18:23). The collection and delivery of the offering for the Jerusalem poor had been completed (Gal. 2:10) when Paul wrote the Letter to the Galatians. The provenance of the letter is the apostle's Caesarean imprisonment, c. A.D. 57-58.

Microfilm \$4.80; Xerox \$16.90. 375 pages.

SOCIAL PSYCHOLOGY

THE SUGGESTIBLE PERSONALITY: A PSYCHOLOGICAL INVESTIGATION OF SUSCEPTIBILITY TO PERSUASION.

(L. C. Card No. Mic 61-242)

Hans Henry Leo Abraham, Ph.D.
Columbia University, 1960

One hundred and one students at Columbia University, enrolled in first-year psychology classes, served as subjects of the study. The aim of the investigation was to 1) contribute to the theory of communication research by

contributing to our knowledge of the intervening variables between the presentation of constant social stimuli and the diverse verbal, perceptual and behavioral responses observed in different individuals; 2) to investigate the relationship between ideomotor, perceptual and verbal susceptibilities to suggestion within the same individual and 3) to determine a method for predicting susceptibility to different types of persuasive communications from a study of the individual's reaction to non-verbal stimuli and an investigation of certain of his personality traits.

It was hypothesized that there are measurable personality needs, autonomy and deference, which predispose

individuals towards high or low suggestibility, in various types of influence situations, and that individuals who are susceptible to suggestion in non-verbal sensory tests are also susceptible to persuasion in opinion change tests. It was further hypothesized that perceptual field dependency as measured by the ability to reject the influence of the surrounding field in isolating geometric figures is associated with susceptibility to persuasion in written communications as well as suggestibility in ideomotor tests.

The same procedure was followed for all subjects. They were given the Edwards Personal Preference Schedule, a personality inventory for normal subjects; two ideomotor tests: the Heat Test, a suggestibility Test constructed by the author and designed to discriminate between suggestible and non-suggestible subjects; an Odor Test with similar purpose; and a perceptual test, which was given to discriminate between those subjects who could reject the influence of the surrounding field and those who could not easily do so. In addition the subjects were given a persuasibility test designed to discriminate susceptibility to persuasive communications (propaganda) of varied types of appeal and content designed by the author.

The above hypotheses were substantiated. On the basis of the results obtained from this study of the relationships between certain personality variables and various types of suggestibility or persuasibility, it may be concluded that persuasibility is not an isolated trait, peculiar to a particular topic, or specific situation, but appears to have an element of generality, contributing to consistent individual differences in susceptibility to suggestion from diverse sensory, perceptual and verbal sources of influence. Furthermore, it is shown that suggestibility in the older sense of response to perceptual and sensory cues (heat, odor, geometric figures) is clearly related to persuasibility in the sense of susceptibility to propaganda or verbal persuasive communications, and that both these forms of responding are related to the relative degree to which the personality needs of autonomy and deference manifest themselves in individuals and exert a predisposing force towards susceptibility to influence.

The outstanding result of this study, then, is that, contrary to widespread belief, persuasibility is not an isolated trait, but appears to have an element of generality contributing to consistent individual differences in susceptibility to influence from diverse sensory, perceptual and verbal sources.

Microfilm \$2.75; Xerox \$7.20. 155 pages.

AN INVESTIGATION OF THE
AUTHORITARIAN FIGURES IN
THE LIVES OF ADOLESCENTS AS
MEASURED BY A FORCED-CHOICE INSTRUMENT

(L. C. Card No. Mic 60-6436)

Charles Richard Dolan, Ed.D.
Boston University School of Education, 1960

The Problem: The major objective of the study was (1) to examine adolescent attitudes toward those persons within the adolescent frame of reference who maintain an implied or actual authority over the adolescent, and (2) to determine which of these "authorities," among the twenty-

four selected figures, appear to youth to fill this authoritarian role.

Scope and Limitations of the Study: The pupil population sample consisted of 1436 students, representing eighth and tenth grade levels, from five selected New Hampshire junior-senior high schools. This sample provided certain limitations to the study since New Hampshire is predominantly rural, with the largest city included in the sample not exceeding 30,000 population.

The core of the study was the construction and evaluation of the D A FIGURES SCALE, as an instrument constructed for the purpose of the identification of the authoritarian figures to be found in the lives of adolescents.

Procedure: In addition to the administration of the D A FIGURES SCALE, a standardized scholastic aptitude test was administered to the sample population for the purpose of determining range of academic potential.

Anonymity was maintained throughout the testing program in order to encourage pupils to feel free to react frankly to the "authoritarian" scale.

Variables present in the study were (1) age, (2) grade, (3) sex, (4) religious preference, (5) socio-economic status (based on father's occupation), and (6) intelligence.

Major Findings and Conclusions: The two forms of the primary scale, "A" and "B", were correlated for reliability, a reliability coefficient being reached of .84. Through the administration of the scale, and the correlation of the results by an analysis of variance statistical measure, the assumption of "face" validity by "definition" appears to have been supported.

Through an analysis of variance, correlations were made resulting in SIGNIFICANT DIFFERENCES IN MEAN VALUES:

BETWEEN THE SEXES;

BETWEEN THE SEXES AT DIFFERENT AGE LEVELS;

WITHIN SEX AMONG AGE GROUPS;

BETWEEN THE SEXES WITHIN RELIGION;

WITHIN SEX BY RELIGION;

BETWEEN THE SEXES WITHIN SOCIO-ECONOMIC STATUS;

WITHIN SEX AMONG SOCIO-ECONOMIC GROUPS;

BETWEEN THE SEXES WITHIN IQ QUARTERS;

WITHIN SEX AMONG IQ QUARTERS.

Summary: In descending rank order the female authority figures which appear to be disturbing to GIRLS are: grandmother, mother, aunt, school nurse, younger sister, and coach. Neighbor, unidentified in the study as male or female, also appears as a significantly disturbing figure to girls.

In descending rank order, BOYS appear to be disturbed by: principal, school bus driver, policeman, truant officer, and janitor. Father is a less disturbing figure to boys.

Dentist appears to be a less disturbing figure to both boys and girls than doctor. Aunt and uncle appear to be equally disturbing, or equally non-disturbing, figures, together. Clergyman is a non-disturbing figure, generally, but, when disturbing to any degree, tends to be highly disturbing. Brothers and sisters (younger and older) appear to be more disturbing to girls than to boys. (The girls' concern with female figures, and boys with male, may be

an example of displaced mother and father hostility as an oedipal situation.) Familial ("home") figures tend to be disturbing as a group, with outside (the home) figures receiving relatively low scores on the scale. The inverse was found to be true in the school situation. Teacher, older brother, classmate, grandfather, and librarian, in rank order, appear on the lower end of the scale as non-authoritarian figures.

Microfilm \$2.75; Xerox \$7.60. 162 pages.

PERSONAL COMMITMENT:
A STUDY OF COGNITIVE PROCESS.

(L. C. Card No. Mic 61-418)

Catherine Riegger Harris, Ph.D.
University of Maryland, 1960

Supervisor: Assistant Professor Margaret T. Cussler

This exploratory study relates opinions obtained from twenty-six persons on a varied series of ten issues to the reported cognitive experiences of these persons. Interviews lasted approximately one hour. Special attention was paid to getting information on the self-interpreted reasons why the persons took the positions they did, including: (1) the observational and conceptual basis for the opinion; and (2) the basis of the opinion in terms of personal history, i.e., how the individual felt he had come to acquire a particular perspective.

The interest of such inquiry to sociology lies, we believe, in the fact that it examines: (1) processes whereby individuals as active agents help to construct certain social goals, appraisals, and concepts, alone or in consensus; and (2) processes whereby individuals come to accept as valid, reject as invalid or inappropriate, or in some way modify views available in the culture.

The study presents a theory of attitude in conjunction with the investigation of cognitive process. Attitude is defined as expressive psychophysical or mental positioning which an organism assumes in response to an apprehended situation or in response to an internal impulse to expression. The taking of an attitude can be construed as the adoption of a means to the fulfillment of some end. The end may relate either to something further to be achieved or facilitated through the positioning of self, or it may reside directly in the fulfillment of the impulse to take a position or direction.

The definition of attitude as an act of self-positioning leads into the chief focus of the study, the examination of the reported perceptions and ideas accompanying the taking of a particular position.

Persons included in the study attributed many aspects of their opinions to direct perceptions and personally validated experiences, and also felt that many of their "derived" opinions were capable of such validation.

On more removed political or technical issues, reference to direct validating experience was less frequent than in the more directly personal area. Persons did not disqualify themselves from commitment on informational grounds when they had a strong sense that a moral issue or social danger was involved in a particular question. A marked apprehension or judgment of this kind carried

with it a sense of cognitive competence and unwillingness to delegate functions of judgment.

Perceptions and conceptions were often specialized in terms of the current activities and interests in which the individual was involved. Specialized experiences seemed to incline persons to give weight to certain qualities and events in the environment and to fail to note or utilize other aspects thereof. Personality variations as well as extrinsic circumstances contributed to specialized social experience and to individual differences in the kinds of situations and qualities noted, problems perceived as important, and the interpretation of culturally acquired ideas.

The specific situation-bound nature of many judgments was apparent in much of the interview material. Attitudes toward persons, groups and policies in one context were not always consistent with attitudes toward the same objects in other contexts. Sometimes, for example, a person would regard a social "authority" or group in an alienated critical perspective while in another context the attitude toward the same persons or groups would be accepting and non-critical.

Sometimes persons felt that an acceptable end conferred acceptability on a "practical" means, provided that abstract social disapproval of the means did not already exist. Means, on the other hand, were sometimes not appraised as practically necessary in relation to an accepted end if a prior attitude of moral disapproval in regard to these means had been established.

Microfilm \$5.45; Xerox \$19.35. 428 pages.

SMOKERS' REACTIONS TO
A TELEVISION PROGRAM ABOUT
LUNG CANCER: A STUDY OF DISSONANCE.

(L. C. Card No. Mic 60-6739)

Jonathan Page Lane, Ph.D.
Stanford University, 1960

A program about lung cancer was presented by a San Francisco television station April 24, 1959. It included an operation to remove a tumor and a denunciation of smoking as the most important cause of lung cancer today.

Hypotheses, derived from Leon Festinger's theory of cognitive dissonance, were:

1. Smokers, who have dissonance, will avoid viewing the program about lung cancer more than others unless they have very high dissonance. If they have very high dissonance, they will view more than others.
2. Smokers who view will distort anti-smoking cognitions offered by the program, make more pro-smoking cognitive changes (or fewer anti-smoking ones), or communicate more to find pro-smoking cognitions than will others, unless they have very high dissonance. If they have very high dissonance, they will accept the anti-smoking message.

Two questionnaires were administered to residents of a married student's housing project, one a few days before the program, the other a few days after. Measures of attitude toward smoking, belief in the smoking-cancer link, intention about quitting and communicatory activity showed satisfactory reliability. (For attitude toward smoking, $r = .77$, for belief in the smoking-cancer link,

$r = .91$.) Evidence for validity of measurement is found in the fact that smokers liked smoking more than non-smokers ($p < .001$), and believed less in the smoking-cancer link ($p < .001$).

Dissonance was defined a priori as some smoking, on the assumption that few people would have very high dissonance. Since as many smokers viewed as non-smokers, a finer index of dissonance was constructed. Low dissonance smokers smoke less than half a pack of cigarettes a day. Moderate dissonance persons smoke more than half a pack a day and have attitudes and beliefs relatively consonant with smoking. High dissonance smokers smoke more than half a pack a day and have exactly one of three measured cognitions (attitude toward smoking, belief in the smoking-cancer link, or intention about quitting) dissonant with smoking. Very high dissonance persons smoke over half a pack a day and have two or three of these cognitions dissonant with smoking. Many smokers fell at the very high end of this dissonance scale.

Analysis of viewing by smokers and non-smokers compares 112 smokers and 117 non-smokers (including Not Homes and Refusals reached by callbacks). Analysis of viewing according to amount of dissonance is based on the 95 smokers who completed pre-program questionnaires. Analysis of reactions is based on the 57 viewing smokers.

Results:

1. The low-moderate-high dissonance group avoided viewing the program somewhat more than did smokers with very high dissonance ($p = .07$). They did not avoid more than non-smokers.

2. The low-moderate-high dissonance groups showed only slightly less acceptance of the anti-smoking message than persons with very high dissonance because persons with high dissonance tended to accept the message. The low-moderate dissonance group showed less acceptance than non-smokers ($p = .02$), and somewhat less than the high-very high dissonance group ($p = .10$).

These differences conform to prediction, but are not large enough to provide real support for dissonance theory.

Related findings:

3. Among persons who filled out the pre-program questionnaire, smokers view more than non-smokers; among those who did not complete this questionnaire, smokers seem to view less. Thus the relation between smoking and viewing is different under the two conditions ($p = .02$). Possibly the first questionnaire roused very high dissonance in many smokers.

4. Smokers who did not intend to quit were less likely to view than smokers who were not sure or said they would quit sometime ($p = .03$). After the program, those who thought of quitting showed anti-smoking reactions, while those with no intention of quitting showed pro-smoking reactions. These groups differed significantly ($p = .001$).

Microfilm \$2.75; Xerox \$6.20. 129 pages.

THE FUNCTIONS OF TELEVISION FOR CHILDREN

(L. C. Card No. Mic 60-6744)

Edwin Burke Parker, Ph.D.
Stanford University, 1960

The rapid growth of television in the decade of the 1950's is a notable example of cultural change in North American society. The nature of that change is examined by comparing children in two Canadian communities, one with television reception on several channels (TVtown) and one with no television reception (Controltown).

Data collected from a total of 913 children in the first, sixth, and tenth grades in TVtown and Controltown permit documentation of the change in behavior--particularly mass media behavior--of children since the adoption of television. The comparison between the two towns permits tests of hypotheses regarding the functions of television, since children in the non-television community can be used as a control group. It also permits indirect testing of a theory of cultural change.

Two postulates that show promise for the construction of a functional theory of cultural change are presented and discussed. The first postulate states, "A new mode of behavior will be adopted by an individual if and only if such behavior serves his needs more effectively than his present behavior and at least as effectively as each of the available alternatives." This postulate assumes that those modes of behavior which are adopted in a culture better serve the needs of the individuals who adopt them than alternate modes of behavior that are displaced or not adopted. Need is defined as, "the lack of something which, if present, would tend to further the survival of the organism or his adjustment to the environment." It does not assume that such modes of behavior contribute to the survival or adjustment of a society *qua* society.

The second postulate states, "The needs served by a new pattern of behavior in any society existed prior to the adoption of the new pattern." It follows that the new pattern of behavior will be similar in function to the displaced pattern. It also follows that hypotheses about the function of a new cultural pattern can be tested if it can be determined what behavior has been displaced and if the function of the displaced behavior pattern is known or can be assumed.

Two functions of television are tested--fantasy facilitation and provision of useful information. When intelligence levels are controlled, TVtown children in the first grade score higher than Controltown children on standard vocabulary tests, particularly in the high and low (but not average) intelligence categories. The information provision function is not tested directly in the other grades, although indirect evidence indicates that the informational advantage is present only for children who lack reading skills.

The predicted failure to find significant differences between the amount of book reading, newspaper reading, and non-pulp magazine reading in the two communities indicates that television is not displacing traditional information sources. That these media are similar in function is shown by the low but significant correlations among them.

Comic books, pulp magazines, movies, and radio are all significantly displaced by television. Both this finding and the finding that there are significant correlations

among them (and between comic book reading and television viewing) indicate that they are similar in function. It is claimed that that function is the facilitation of fantasy.

The findings support both the theorems regarding the functions of television and the postulates for a theory of cultural change. The widespread adoption of television can be accounted for by a fantasy facilitation function of television. Microfilm \$2.75; Xerox \$6.60. 136 pages.

AN ATTEMPT TO DETERMINE
SOME CORRELATES AND DIMENSIONS
OF HEDONIC TONE

(L. C. Card No. Mic 60-6588)

Warner Rushing Wilson, Ph.D.
Northwestern University, 1960

Supervisor: Dr. Donald T. Campbell

This study of happiness had two major aspects: a definitional attempt and a theoretical attempt. The purpose of the definitional aspect was to determine the relation between various affective states. The states chosen were: happiness, unhappiness, depression, elation, anxiety, contentment, serenity, and satisfaction. The self-report of the *S* was relied upon as a measure of these variables and a number of other variables included in the study. The *S* responded by indicating whether the statements in a long inventory were true or false of him. A number of questions were used to measure each variable. All of the scales measuring these eight states loaded heavily on the happiness factor which accounted for approximately ninety per cent of the variance. Some evidence of a second factor was found. Anxiety, satisfaction, and serenity loaded about as heavily on this second factor as on the happiness factor, while the other five states did not have sizeable loadings on this factor. The second factor was tentatively identified as emotional reactivity. Intercorrelations among the various states were also examined in terms of unattenuated correlations and correlations with other variables. In general these analyses were in agreement with the

results of the factor analysis. Correlations were obtained between a composite of the eight hedonic scales and other variables which illustrate the confusion which can result when a factorially complex scale is interpreted as though it were a measure of a single theoretically important dimension.

A tentative theory was formulated based on the assumptions that need fulfillment is the cause of happiness and that needs are subject to adaptation effects, sometimes powerful but never complete. A number of implications were derived from these three postulates. Some of the implications pertained to the kinds of cultural values that would promote happiness; others referred to correlates of happiness on the individual level. An attempt was made to use this theoretical structure to predict the association between happiness and a number of the other variables measured in this investigation. Family adjustment and social adjustment were interpreted as major needs, and it was predicted that these variables would be related to happiness. This prediction was confirmed. Success in dating also showed a significant, though small, correlation with happiness. No evidence was found of any relation between happiness and family income, spending money, or grades.

The theory assumes that some needs are culturally determined and that some cultures may produce unhappiness by encouraging individuals to have more needs than they can satisfy. The United States was judged to have such a culture, and it was predicted that individuals having relatively high needs for achievement would be less happy. This prediction was not confirmed. Another group of items which called for a self-report on the discrepancy between need for achievement and actual achievement did show a definite correlation with unhappiness.

Finally, it was predicted that persons with liberal attitudes toward sexual activities would be more free to satisfy their needs and hence would be happier. Instead, a significant tendency was found in the opposite direction. Several factors were considered that might account for negative and contrary results where they were obtained. Some additional findings were that females are happier than males; that estimates of parents' happiness and estimates of own happiness are positively related; that happiness and aggression are negatively related; and that intelligence is not appreciably related to happiness.

Microfilm \$2.75; Xerox \$8.20. 178 pages.

SOCIOLOGY

SOCIOLOGY, GENERAL

LAND TENURE AND RURAL SOCIAL ORGANIZATION: A STUDY IN SOUTHERN IRAQ.

(L. C. Card No. Mic 60-5898)

Fuad Baali, Ph.D.
Louisiana State University, 1960

Supervisor: Professor Alvin L. Bertrand

The major purpose of this study is to analyze the land tenure system and problems in southern Iraq up to 1958. In Iraq, as in many other agrarian countries, the question of land tenure is a matter of life and human dignity to great numbers of people. Land tenure problems are, thus, in a broad sense of the term, social problems. They are social problems of man-to-man and man-to-society relationships with reference to the use and control of land; they are also concerned with human traditions, values, behavior and attitudes toward the land. The theories which deal with land tenure problems are, therefore, social theories because they deal with social interaction.

This study, which is largely based on participant observation (and informal interviews), represents an attempt to show that social problems arising out of land ownership have a long history in Iraq. In brief, the confused state of the land tenure system was created by the Ottoman government, maintained by the British Army, and inherited and encouraged by the former Iraqi governments. The main point in this study is that the land owned by the large landlords, or shaikhs, was held in what might be described as an illegal tenure. The tribes of southern Iraq have for many decades been exercising a customary right of land ownership. The shaikhs were able, with the help of the government authorities, to register the whole tribal land in their names, without investigation or consideration of the right of the tribesmen. As a result, the relation between the shaikh and his tribesmen became a relationship of landlord-share tenants. The shaikhs became not only the sole owners of the land but also the masters of the land and the most influential people of rural Iraq.

The share-tenancy system gives the landlord a say in arranging the contract with the peasant, or fellah. The latter who receives less than one-third of the produce, has to pay many illegal contributions to the shaikh. These contributions leave the fellah always in debt. Law No. 28 of 1933 gave the shaikh the right to keep the fellah on the land as long as the latter is indebted. This state of affairs led the fellah into the position of serf-tenant. On the whole, this system has great effect on the rural social organizations of southern Iraq such as the family, education, health, and social stratification.

Many problems have resulted from this system, such as:

1. The extreme inequality of land ownership.
2. The depressed economic condition of the fellah, because of his extremely low income.

3. The poor health of the fellah, because of the unbalanced diet and the relatively lack of medical care.

4. The high rate of mortality.

5. The illiteracy which is a result of the lack of schools in the villages.

6. The growing discontent of the fellaheen who occupy an inferior position.

7. The lack of cooperation between the landlord shaikh and the sharecropper fellah.

8. The discouragement that the fellah faces which prevents him from improving the plot of land which he cultivates.

9. The migration of the fellaheen to the cities, a movement which has social, economic, and psychological repercussions.

10. The breakdown of the tribal system and the tribal solidarity (*assabiyah*).

11. The continuous dispute and quarrels between the tribes over the land (which disturb public security).

12. The deterioration of economic life, resulting from this system which is an obstacle to agricultural development.

13. The political and administrative corruptions caused by the system.

The former governments did not seriously attempt to solve the problem. Improvement of the land tenure conditions requires not only an equitable distribution of holdings but also a better landlord-tenant relationship. This is precisely what the revolutionary government is seeking by its Agrarian Reform Law of 1958.

Microfilm \$3.00; Xerox \$10.60. 232 pages.

A STUDY OF SELECTED RECOMMENDATIONS OF THE NEW YORK STATE TEMPORARY COMMISSION ON THE COURTS

(L. C. Card No. Mic 61-501)

Robert Bodkin, D.S.S.
Syracuse University, 1960

The purpose of this study is to apply an analysis of selected recommendations of the New York State Temporary Commission on the Courts for auxiliary services to a statewide family court. This includes a comparison with an existing similar service to determine the adequacy of such services to the task of handling a selected problem. The problem is that of repetitive inappropriate drinking behavior. As background to the study, the origins of the special courts for the family are shown to lie in social jurisprudence.

It was found that the Commission's recommended auxiliary service displayed a marked correspondence to the existing service in the areas of organization, function, methods and population addressed.

A frequency study identified the selected problem,

alcoholism, in 37.3 per cent of the cases comprising a sample of the caseload of the existing service. Repetitive contact with the service was found to be a characteristic of the majority of these cases. This observation suggested the possibility that the existing service does not have available methods and procedures adequate to the special needs of such individuals in terms of arresting the condition. A study of the pertinent literature suggested that the given individual requires and resists treatment because of the physio-psychological nature of his condition. Court-ordered continued contact with a therapeutic resource is suggested by the writer as the basis for a procedure for handling this condition in the setting of the special court for the family and its auxiliary service.

The method basic to this alcoholism control procedure was found to run counter to the prevailing philosophy of the special courts for the family and their auxiliary services recommended by the Commission. This prevailing philosophy is characterized by an apparent reluctance to invoke the authority of the court, particularly its sanctioning power, and as being antithetical to such tenets as: discovery and treatment of root causes rather than punishment of manifest symptoms; social sciences as opposed to purely legal science as oftentimes being more appropriate to dealing with social problems. Finally, there appears to be an assumption of rehabilitation potential of the population addressed in terms of ability to understand and approximate set behavioral standards, which is assumed to result from motivation arising from the perception of the incentives held out by the service as being valuable and attractive.

It was concluded that further research is indicated to determine the utility and role of authority in the setting of the special courts for the family and their auxiliary services. Microfilm \$4.90; Xerox \$17.35. 382 pages.

THE CHANGING FOLKWAYS OF PARENTHOOD: A CONTENT ANALYSIS.

(L. C. Card No. Mic 60-6283)

Herbert Lee Costner, Ph.D.
Indiana University, 1960

This research attempts to assess changes in the concerns of parents for their children since 1890, and to explain those changes within a general sociological framework.

Changing parental concerns were assessed by a content analysis technique not previously utilized which is presumed to be useful in inferring the beliefs of a reading audience from communication content. The communications analyzed were random samples for each five-year period since 1890 of articles of advice to parents in popular magazines. It was reasoned that the writers of advice have made assumptions about the concerns that are important to their readers, and that these assumptions can be inferred from article content. More specifically, we have assumed that an article in which the writer promises a particular result if his advice is followed, and in which the writer elaborates no reasons why that result should be considered desirable, indicates that that writer has assumed that that promised result is an important

concern of his readers. We have further assumed that most writers will be accurate most of the time in assessing the concerns of readers. With the additional assumption that the proportion of writers who present such an undefended promised result is proportional to the degree of concern among the readers, we have a basis for inferring beliefs of the reading audience from the content of the literature of advice.

Utilizing this reasoning and a procedure based upon it, inferences are made about the degree of concern for different types of goals in each five year period from 1890 to 1958. This data yields a ranking of goals for each period and trend data for single goals over the whole time span. Among the findings, the following are notable: (1) declining concern for "moral character"; (2) increasing concern for "psychological adjustment" and "social adjustment"; (3) no trend in concern for "congenial parent-child relations" prior to 1950, but a marked increase thereafter; (4) no trend in concern for "self reliance" although a shift of emphasis from "self restraint" to "self direction" is noted. The rank ordering of the nine principal goals shows greater departure from the rank ordering at the turn of the century for each succeeding decade up to 1950, as measured by the rank order correlation coefficients.

Although no formal rationale is offered for inferring the degree to which the writers' advice is followed by readers, the advised policies were classified and tabulated. Some fluctuations in the number of writers advising various policies were observed, but statistical tests indicate that the hypothesis of no trend cannot be rejected for any single type of advice. There have, however, been some changes in the "tone" of advice too subtle to be reflected by the classifications used.

Finally, three general models are presented which describe processes of change in role structures and which could account for the changes in parental concerns. These models focus attention upon changed requirements for offspring success in extra-systemic roles, upon changed parental self conceptions resulting from changed extra-systemic roles of mothers, and upon the loss of a rationale for "hard" child training with the decrease in the weight and urgency of household task requirements.

Microfilm \$5.30; Xerox \$18.90. 416 pages.

SOME FACTORS IN THE MIGRATION OF CONSTRUCTION WORKERS

(L. C. Card No. Mic 60-6982)

Alfred Maxey Denton, Jr., Ph.D.
The University of North Carolina, 1960

Supervisor: Daniel O. Price

In 1952 and 1953 over 38,000 workers were employed in building the Atomic Energy Commission's Savannah River Plant in South Carolina. This study was undertaken in order to learn something about the families who migrate to such construction projects, to see whether the families who owned trailers differed in any major respects from other migrant families, and to investigate the reasons why these families migrate as they do. Samples were selected and families were interviewed in privately owned trailers,

Project-sponsored trailers, and in towns surrounding the construction site. In all, 821 white migrant families were interviewed.

The migrant families were slightly smaller than the average for all white families in the United States. They were not likely to have more than five members nor less than three, and tended to be young families with the husband and wife under 35 years of age. About 75 per cent of the children were under 10 years of age.

Trailers were inhabited largely by skilled and semi-skilled workers, with officials, professional and technical workers preferring to live in conventional houses. About 75 per cent came from less than 600 miles away.

Average age of family heads tended to increase as distance migrated increased, and when each distance zone was studied as a separate unit, the proportion who were in the 50 to 59 age group remained about the same or increased slightly.

The data indicated that there was little or no relationship between size of family and distance migrated, but distance was related to other variables. (1) The longer the distance migrated the more likely a family was to have made several previous moves. (2) The longer the distance migrated the higher the family income tended to be. (3) The longer the distance migrated the more likely a wage earner was to have sought job information from formal sources and he was more likely to have contracted for a job before moving.

It was found that many "job information networks" exist among the workers who move frequently. Such networks serve to keep them informed as to where the best jobs are located, and serve to pass on other information about the communities, schools, and other factors a family takes into consideration when trying to decide where to move.

It has been hypothesized elsewhere that persons in certain occupations, because of the nature of the occupations and the relative locational stability of the occupations, are more predisposed to migrate than others. From the study of these migrant families, the impression was gained that many of them like to move, and actually seek jobs that will enable them to move occasionally. Such movement may enable them to achieve some of the same "marks" of middle-class status that more sedentary families in the white-collar occupations achieve. For example, a move to another part of the country serves the same purpose that an annual vacation does for some families. This aspect of migration warrants more careful study by sociologists.

Microfilm \$2.75; Xerox \$7.00. 148 pages.

SOCIAL WORK IN THEORY AND PRACTICE: EXPECTED BEHAVIORS IN SOCIAL CASEWORK.

(L. C. Card No. Mic 61-507)

Hans Siegfried Falck, D.S.S.
Syracuse University, 1960

This dissertation is an attempt to link several conceptual constructs to each other and to learn the nature of their relationships. More concretely, it is hoped to attain at least a partial, operational definition of the professional behavior of social caseworkers.

The question is posed as to what the relationships might be between three sets of ideas. They are: (1) a social-systematic definition of professionalism; (2) a practice-theoretical formulation of social work behavior; (3) a set of verbalizations about operational social casework behavior.

The procedures followed in the investigation are three-fold. First, we examined the writings of Talcott Parsons for his social-systematic definition of medicine and investigated its relevance to social work; secondly, we perused primary social work sources for formulations of social work professionalism; third, we conducted a field study to gather data which we examined for relationships to the sociological as well as social work theoretical constructs mentioned earlier.

The sociological investigations showed that while social work might accept some concepts, it would have to modify others. Especially noteworthy in this connection is the change necessary in Parson's idea of affective neutrality as it relates potentially to social work. The social work theoretical investigation was used as a confirming and modifying mechanism in relation to the sociological analysis. It was found that some fairly adequate amounts of materials were available to do this job. The field study showed that workers on the job tend to bear out theoretical social work formulations, generally speaking, and that workers could handle theoretical rationales for their work with some facility. However, there is very considerable unevenness in respondents' choice of rationales and concepts, and it seemed on the whole that workers would most often deal with concepts and ideas subject to very general kinds of formulations. While thirteen (13) major behavior rationales (practice theoretical constructs) were identified, they were not all used too consistently. While the four (4) most frequently mentioned rationales were utilized by in excess of eighty (80) percent of the respondents, the other nine (9) were identified from fifty-nine and five one-hundredths (59.5) percent downward to sixteen and nine one-hundredths (16.9) percent with a median of forty-one (41) percent.

The main conclusions are that while respondents identified practice theoretical concepts frequently and clearly enough to justify certain observations about their relationship to "what the books say," more effort might be called for in professional teaching and in-service training to broaden workers' perceptions. More importantly, however, the research demonstrates what is at least a beginning manifestations of social work practice-theoretical concepts which are identifiable and presumably applied.

Microfilm \$2.75; Xerox \$7.80. 168 pages.

SOCIAL CLASS AND ACADEMIC ACHIEVEMENT AT LAW SCHOOL

(L. C. Card No. Mic 60-6730)

David Feldman, Ph.D.
Stanford University, 1960

The dissertation was concerned with a study of the perseveration of the social class effect upon academic achievement. Specifically, the research focused upon two questions: (1) Does academic achievement, found to be

related to social class at the high school level, continue to be related to social class at the post graduate level of professional legal training? (2) If so, can these differences in academic achievement still be attributed to the presence of class-related motivational differences? The investigation was carried out with questionnaire data and information from official records relating to 213 white, married and single, first, second and third-year male law students enrolled at Stanford Law School during the 1956-57 academic year.

Social class was measured by Hollingshead's Two Factor Index of Social Position, a scale based on the weighted measures of the occupation and education of the students' fathers. The index of law school achievement, the dependent variable, was examination grades obtained at the end of first year of law school. Motivation was measured by a six item Guttman scale that focused on the individual's degree of commitment to pursue a legal career.

The major hypothesis of the study was that in part achievement at law school is a function of social class. The findings of the study were consistent with the hypothesis. It was found that individuals in Class I and II (upper and upper-middle class) had a significantly better achievement record in their first year of law school than those in Class III and IV (lower and lower-middle class). The former group had significantly more students in the highest achievement category, and conversely, were less often found at the lower achievement levels. Moreover, this relationship between class and achievement in law school was shown to hold even when legal aptitude and undergraduate academic achievement were controlled, as well as marital status and religious affiliation.

With regard to the second proposition of the study, it had been hypothesized that high motivation would be more characteristic of Class I and II students and that level of motivation would be positively associated with level of achievement. The former hypothesis was confirmed by the findings for single Protestants; however, Class III and IV married Protestants had the highest proportion of highly motivated individuals. Only the data for students in Class III and IV were consistent with the hypothesis on the relationship between motivation and academic achievement. These latter findings, however, provided support for the final hypothesis of the study, that highly motivated lower class individuals would not significantly differ from highly motivated upper and upper-middle class individuals in their achievement at law school.

In summary, the findings of the study demonstrate that social class persists as an important factor in academic achievement even at the level of post-graduate legal training, and that these differences in part can be attributed to the absence of high motivation for a legal career among lower and lower-middle class students.

Microfilm \$2.75; Xerox \$5.80. 120 pages.

THE COMMUNITY AS A SOCIAL SYSTEM: A STUDY IN COMPARATIVE ANALYSIS.

(L. C. Card No. Mic 61-299)

Leonard Earl Griswold, Ph.D.
University of Kentucky, 1956

Director: Dr. Irwin T. Sanders

The purpose of the study is to construct from existent theoretical materials a conceptual scheme for the comparative analysis of selected data from studies which have been made of total communities by social scientists. The community studies used were selected by taking a twenty-five per cent sample of all studies of total communities which have been reviewed in the four major sociological journals since 1925. Nine studies were included in the analysis.

1. Fried, Morton H., The Fabric of Chinese Society, 1953.
2. Leonard, Olen, and Loomis, Charles P., The Culture of a Contemporary Rural Community, El Cerrito, New Mexico, 1942.
3. Quain, Buell H., Fijian Village, 1948.
4. Rogler, Charles C., Comerio, A Study of a Puerto Rican Town, 1940.
5. Spicer, Edward H., Pascua, A Yaqui Village in Arizona, 1940.
6. Tumin, Melvin M., Caste in a Peasant Society, 1952.
7. Wagley, Charles, Amazon Town, 1953.
8. Warner, W. Lloyd, and Lunt, Paul S., The Social Life of a Modern Community, 1941.
9. West, James, Plainville, U. S. A., 1945.

Each community study is presented in a reorganized and condensed form in such a manner as to allow for comparison of the data. In the model developed for comparative analysis, the community is viewed as a social system made up of a number of interrelated subsystems. The subsystems chosen for analysis include economy, kinship, education, local government, and religion. In some communities all of these subsystems are well-developed; in others, some subsystems appear combined or are missing entirely. Subsystems differ in the extent to which they are integrated into the social system of a community. Many subsystems within a community are actually a part of other systems or "supersystems" which penetrate the local community.

Community social systems are also viewed as having several generic elements of which concrete structures are the most significant. The remaining generic elements may be observed operating within concrete structures. They include value orientation, conformity-deviation controls, and reciprocal status-role specification. Analysis of these generic elements includes a comparison of the dominant and variant value orientations manifested by each, and a discussion of the following: how behavior is controlled within each community system, and how personnel are allocated among the roles of community systems.

Throughout the analysis, a community social system is viewed as an operating whole in which each part has definite functions which must be performed, or else substitutes acquired, if the community is to maintain itself in its setting. Each subsystem is studied from the standpoint of its internal relations, how it is related to the community social system, and how it is affected by the larger society of which it is a part.

Microfilm \$3.75; Xerox \$13.05. 289 pages.

**GROUP STRUCTURE AND OPINION
CHANGE: A STUDY IN SMALL
GROUPS AND MASS COMMUNICATION.**

(L. C. Card No. Mic 60-6733)

Barbara Aileen Wells Gunn, Ph.D.
Stanford University, 1960

This was a study of the effect of group discussion on opinion change in three different kinds of groups. In a more general sense it was an attempt to integrate findings from two areas of research--mass communications and the study of small groups. It was an attempt, in the words of Katz and Lazarsfeld, to "make room for people as intervening factors between the stimuli of the media and resultant opinions, attitudes, and actions."¹

The media stimulus was a radio broadcast by Psychoanalyst Erich Fromm on the subject of Freud and the American consumer. The broadcast was one of a series sponsored by the Community Education Division of San Bernardino Valley College and heard by groups of from ten to fifteen people who met regularly to listen to and to discuss such programs. The groups have no pre-designated leaders and are not required to make any kind of decision.

Opinion change attributable (1) to the broadcast and (2) to the discussion was measured in three groups of varying structure--a long-established friendship group, a newly organized group, and a group brought together for the specific influencing session. Changes of opinion toward the communication (a major concern of communication theorists) were measured as well as changes of opinion toward the group mean (a major concern of small group theorists).

It was hypothesized that conditions in the long-established friendship group would be nearest to what Lewin described as optimum for re-education (voluntary attendance, informality of meetings, freedom to express grievances--an atmosphere of freedom),² and, therefore, that group would have the greatest amount of opinion change toward the communication. It was further hypothesized that the long-established friendship group would have the greatest pressure toward conformity and thus that group also would have the greatest opinion change toward the group mean. Other hypotheses concerned increased sureness after discussion, changes in opinion to follow Osgood's principle of congruity,³ and leadership in these leaderless discussion groups.

Group discussion had no significant effect upon opinion change toward the communication in any of the three groups, but did cause a significant change toward the group mean in the long time friendship group. (Computa-

tion of the significance of differences between the standard deviations on the opinion test before and after discussion yielded a *t* of 1.86 significant at the .05 level using a one-tailed test.)

Perceived leaders ranked high in number of communicative acts, but were not close to the group norm in opinion scores. Members were more sure of their opinions after discussion. The study did not seem to offer an adequate test of the principle of congruity because all members were initially favorable to both the concept and the source.

The conclusion drawn from the research was that discussion per se has no appreciable effect on opinion change toward the communication. This would suggest that the changes brought about in the Lewinian food-changing experiments⁴ may have been due (1) to the effectiveness of the group leader in making the norms of the group congruent with the communication message or (2) to something in the decision or commitment process rather than to discussion alone.

The research, however, demonstrated once again the effectiveness of the primary group in bringing about opinion change toward the group mean.

1. Elihu Katz and Paul Lazarsfeld, *Personal Influence* (Glencoe, Illinois: The Free Press, 1955), p. 32.

2. Kurt Lewin, *Resolving Social Conflicts* (New York: Harper, 1948), p. 65.

3. Charles Osgood, George Suci, and Percy Tannenbaum, *The Measurement of Meaning* (Urbana, Illinois: U. of Illinois, 1957).

4. Kurt Lewin and Paul Grabbe (eds.), "Problems of Re-education," *Journal of Social Issues*, 1945, I, No. 3.

Microfilm \$2.75; Xerox \$7.00. 147 pages.

**ROLE-EXPECTATION PATTERNS
AMONG UNITED STATES AND
MEXICAN HIGH SCHOOL STUDENTS:
AN EMPIRICAL STUDY OF SOME
APPLICABILITIES OF THE
SOCIAL SYSTEM SCHEMA.**

(L. C. Card No. Mic 60-3402)

Frank Comstock Nall II, Ph.D.
Michigan State University, 1959

Major Professor: William H. Form

The general focus of the study was a sub-area of the problem of moral integration of society. A range of data drawn from high school students living within the metropolitan communities of El Paso, Texas, and Ciudad Juarez, Mexico, was gathered and analyzed. The frame of reference which structured the research was that of the social system schema. The study had two principal purposes: the exploration of the applicability of the social system schema to a limited problem in empirical analysis, and the furtherance of general sociological knowledge of the structure of social relations in the United States-Mexican border area.

Four principal propositions derived from the social system schema were formulated and subjected to empirical

testing. The relationship between cultural value standards and social role-expectations was examined and it was inferred from the findings that social role-expectations do not necessarily represent an unmodified transposition of cultural value standards. The relationship between the extent of differentiation of social relations in a social system and the universalistic-particularistic dimension of role-expectations was examined also. It was inferred that as the extent of differentiation increases the incidence of universalistic-type role-expectations increases also. Finally, the relationship between the extent of differentiation in a system and the self-collectivity dimension of role-expectations was examined. It was inferred that as the extent of differentiation increases the incidence of collectivity-orientation toward the family decreases and the incidence of collectivity-orientation toward the peer group increases.

Ethnic status differences were found to account for differences in the patterns of role-expectations exhibited by the United States students. Social status differences did not appear to be related to the patterns of role-expectations exhibited, except with respect to the high status Mexicans and Anglo-Americans. These latter showed convergence in role-expectations types.

It was concluded that the data imply either (1) that the system of social relations in which both the Mexican and United States students are involved lack a high level of order, or (2) that a high degree of moral integration may not constitute so vital a feature of the maintenance of stability and order as Parsons and others would suggest. This study favored the latter view.

Microfilm \$3.50; Xerox \$12.15. 270 pages.

SOME SOCIAL INFLUENCES IN THE DEVELOPMENT OF MAJOR RELIGIOUS DENOMINATIONS IN KENTUCKY

(L. C. Card No. Mic 61-306)

Paul David Richardson, Ph.D.
University of Kentucky, 1956

Director: Dr. James W. Gladden

The study traces and seeks to explain the development of five denominations--Baptist, Catholic, Methodist, Disciple, and Presbyterian--in Kentucky during a period of 160 years (1790-1950) in which a radical social and cultural transformation occurred.

The bulk of the study consists of a consideration of the relationship between the differential development of denominations and such social factors as net population change, fertility, education, and economic status. The main assumption underlying the problem is that as the state has moved from a frontier society toward an urban-industrial society that the socially-defined function of the church has changed.

Because the availability of data varies widely within this period, two main methods--the historical and the statistical--are applied in the analysis of the materials. The application of the historical method to the scant materials of the early portion of the time span (1790-1890)

provides a valuable background for the study. The application of statistical techniques to the more adequate data, in the latter part of the period (1890-1950), makes possible a much more detailed analysis.

An analysis of the association of population changes and the development of major religious denominations in Kentucky reveals that changes in Kentucky's population had varied effects upon the denominational patterns of development. Changes in membership distribution in some of the major denominations conformed more closely to changes in population than did others.

The study reveals that the rural rather than the urban environment was clearly more conducive to growth of the three major denominations--Baptist, Methodist, and Disciple--that grew most rapidly in the social environment of the frontier. This is of sociological significance because of the similarities between the folk-type social environment of the frontier and the later rural social environment. On the other hand, the urban social environment was more conducive to growth of the two major denominations--Catholics, and Presbyterians--that grew least rapidly in the social environment of the frontier.

By the use of partial correlation analysis the relationships between the development of denominations and selected social factors are studied. Although the statistical analysis fails to show any highly important relationship of this nature the widely varying patterns of denominational development indicate that certain social areas are more conducive to the growth of some denominations than others. The relationships between the development of each of the denominations and the selected social factors varied widely. This also held true with each denomination in different geographical areas and at different time intervals.

A number of hypotheses are tested in the study which show some relationship between the differential development of denominations in Kentucky and selected social factors. Because of the relative crudeness of available data, the precision of measures of relationship was less than might be desired for rigorous testing. Nevertheless, the procedure can be considered not only useful but a necessary step toward the specification of meaningful associations between denominational growth and more generalized socio-cultural changes.

Microfilm \$2.75; Xerox \$8.00. 171 pages.

THE SCANTEX SOCIAL SYSTEM

(L. C. Card No. Mic 60-6639)

Virgil Williams, Jr., Ph.D.
The University of Texas, 1960

Supervisor: Ivan C. Belknap

The dissertation reports the results of an empirical case study of a small rural social system with special reference to its ability to maintain its boundaries through time. The social system is composed of members of a Scandinavian ethnic group and has been maintained for over eighty years despite the location of the system in an area of dominance of a metropolitan center.

The social structure was delineated and related to the viability of Scantex. These features were examined through

interviews and by over four years of participant observation of the behavior of the members. The data thus obtained were ordered through the employment of George C. Homans' distinction between the external and internal systems and Talcott Parsons' concept of system problems.

The relationships observed within the Scantex system do not conform to those predicted by certain concepts of functional sociology. The difference between what was observed and what was predicted raises questions as to the use of these concepts in predicting survival potential. The system studied is surviving, while exhibiting features which are theoretically detrimental to survival.

Microfilm \$4.80; Xerox \$17.10. 376 pages.

SOCIOLOGY, FAMILY

THE EFFECT OF A UNIVERSITY MARRIAGE COURSE ON THE OPINIONS OF STUDENTS REGARDING SELECTED AREAS OF MARITAL INTERACTION

(L. C. Card No. Mic 60-3305)

Richard F. Campbell, Ph.D.
The Florida State University, 1960

The research summarized here had as its purpose the empirical evaluation of opinion change as the result of a functional college course in preparation for marriage. The data were obtained at Florida State University by utilizing a questionnaire designed to elicit opinions regarding several areas of marital interaction. This questionnaire was administered at the beginning and end of a semester to a matched experimental and control group.

The 65 experimental subjects were enrolled in three sections of a functional marriage course. The 65 members of the control group were enrolled in an Education course. The groups were matched by the method of frequency distribution control for the following variables: median test scores for the total questionnaire and each subscale at the beginning of the semester, sex, age, dating status, marital status, religious affiliation, frequency of church attendance, median percentile scores on the California Test of Personality, marital status of parents, and social class membership of respondent's family. No member of either group had ever been enrolled in a previous functional marriage course in high school or college, and no control subjects were currently enrolled in such a course.

The questionnaire which was utilized consisted of 100 statements derived from functional marriage textbooks. The subjects were requested to indicate whether they agreed or disagreed with each of the statements. There were 20 statements about each of the following areas of marital interaction: sex relations, in-law relationships, spending family income, and role recognition, acceptance, and flexibility.

The data which were obtained from the total questionnaire and the five subscales were analyzed by nonparametric statistics. The median test was used to test the significance of differences between median scores of the two groups. Analysis of the post-course data from the

experimental group showed statistically significant increases in median total scores for the instrument and for the subscale regarding religion.

The Wilcoxon matched-pairs signed-ranks test was utilized to analyze the direction and magnitude of changes in scores of the individuals in each group between the beginning and end of the semester. Analyses of changes in scores of experimental subjects showed significantly higher scores at the end of the semester for scores on the total instrument and each subscale. The changes were greatest for the subscale on religious activities and smallest for the one on in-law relationships.

Analyses of changes in scores of control group subjects between the beginning and end of the semester resulted in mixed findings. There were no statistically significant differences between scores on the subscale regarding sex relations, in-law relationships, and spending family income. However, significantly higher scores were evidenced for the subscales relating to religious activities, role recognition, acceptance, and flexibility, and for the total score on the questionnaire.

At the beginning of the semester, the students in both groups showed considerable knowledge of the subject matter of marriage education as evidenced by their median scores on the total instrument and its subscales. This was especially striking for the statements about sex relations.

The evidence from this research suggests that opinion changes do take place as a result of functional marriage education. It also suggests that college students have a considerable knowledge of the contents of marriage education, as it is presented in functional textbooks, independent of whether or not they have taken a course in this area.

Microfilm \$2.75; Xerox \$4.20. 79 pages.

A STUDY OF FACTORS ASSOCIATED WITH WIVES' SEXUAL RESPONSIVENESS

(L. C. Card No. Mic 60-6723)

Alexander Logie Clark, Ph.D.
Stanford University, 1960

The purpose of the research reported in this dissertation was to investigate the relation between certain social and social-psychological factors and the sexual responsiveness of women in marital coitus. This purpose was accomplished by a secondary analysis of questionnaire data obtained from 602 men and women while engaged and in the early years of marriage.

Sexual responsiveness was measured by wives' reports of their frequency of orgasm in marital coitus. Various empirical tests of the adequacy of this measure showed it to be a fairly reliable and valid index of wives' sexual responsiveness.

The major findings of the research may be summarized as follows:

1. The wives in Catholic couples were found to be significantly less responsive in their marital coitus than the wives in couples of other religious faiths, or with no religious affiliation. This did not hold, however, for wives who were highly satisfied with their marriages.

2. Among Protestant couples, the religiously devout wives were less sexually responsive than the nondevout.

3. Wives who were satisfied with their marriages were found to be more sexually responsive than wives who were dissatisfied with their marriages.

4. The quality of the marital relationship was found to be an important condition of the extent to which wives became more sexually responsive with increasing length of marriage. A positive association between length of marriage and sexual responsiveness was observed among wives who were maritally satisfied, whereas no association between these variables was observed among those who were maritally dissatisfied.

5. No association was observed between wives' sexual responsiveness and the neurotic scores of husbands and wives based on their responses to selected items from the Thurstone Neurotic Inventory.

6. A positive association was found between wives' ratings of their health and their sexual responsiveness. For wives in very good health, the better their husbands' health, the greater the wives' responsiveness.

7. The husband's ability to prolong the duration of intercourse was found to be a factor in his wife's responsiveness. This ability was found to be positively associated with husbands' educational level and their ratings of their physical appearance, and inversely associated with the age at which they first learned about sexual intercourse.

Generally speaking, the subjects of this research can be described as urban middle-class people. Also, the subjects were volunteers. For these reasons the findings of this research are tentative, and any interpretations or extrapolations should be made with caution.

Microfilm \$2.75; Xerox \$6.00. 123 pages.

SOCIO-ECONOMIC STATUS AND FORMAL SOCIAL PARTICIPATION OF RURAL MIGRANT FAMILIES IN PITTSBURGH

(L. C. Card No. Mic 61-75)

Gerald O. Windham, Ph.D.
The Pennsylvania State University, 1960

The purpose of this study was to observe the relationship between migrant status and two aspects of social life in Pittsburgh, namely socio-economic status and formal social participation. The data for the study were collected from a random sample of households in the Pittsburgh Metropolitan Area and included information on 1470 families. Three categories were used to classify families according to migrant status, depending upon place of residence up to the age of 15. These were: rural migrants, urban migrants and nonmigrants.

Families were classified according to socio-economic status by a three item index consisting of housing status, family income, and occupation of husband. Housing status was also determined by a three item index consisting of average monthly rent, room per person ratio, and condition of house.

Social participation was viewed at two levels. The first was concerned with total participation as indicated by number of organization memberships, number of meetings attended monthly and number of power positions held in voluntary associations. The second was concerned with

selectivity in participation as indicated by the relative concentration of all participation within specific types of organizations. Inferences were drawn from the latter analysis with respect to emphasis on, involvement in, and potential for influence in the different types of organizations. A separate analysis was made for husbands and wives which permitted a control on sex.

Two general hypotheses were tested in the study. These were: (1) there is an association between the migrant status of families in Pittsburgh and their socio-economic status; and (2) there is an association between the migrant status of husbands and wives in Pittsburgh and their formal social participation patterns. It was predicted that rural migrants would be least favored and urban migrants the most favored with respect to both socio-economic status and social participation. Sub-hypothesis to the general hypotheses were that there would be no association between migrant status and socio-economic status and social participation when personal and family characteristics were controlled.

The analysis showed that housing status and socio-economic status were associated with migrant status. However, urban migrants were more numerous and nonmigrants less numerous in the higher status classes. When education was controlled there was no association between migrants status and housing status or socio-economic status. However, the association did persist when stage in the family life cycle was controlled. Also housing status did tend to improve with length of residence in the community, but this factor was not related to socio-economic status.

There was an association between migrant status and the three measures of total participation for wives. Number of organization memberships was also related to migrant status for husbands. Nonmigrants of both sexes reported more organization memberships and attending more meetings per month than the other migrant groups. This relationship persisted when education and stage in the family life cycle were controlled. Urban migrant wives followed by rural migrants held the most power positions proportionally. There was no association between migrant status and number of power positions under controlled conditions.

The data on selectivity of participation showed no consistent relationship between migrant status and the three qualitative measures of social participation. Nonmigrant husbands and wives placed most emphasis on the church, and urban migrant husbands placed most emphasis on business and professional organizations. Urban migrant husbands were most involved in religious organizations other than the church and rural migrant wives were most involved in the church. Finally rural migrant husbands held the greatest potential influence in the church.

Microfilm \$2.75; Xerox \$7.40. 158 pages.

SOCIOLOGY, PUBLIC WELFARE

A SEQUENCE PATTERN
OF DISASTER AND ITS
CONSEQUENCES FOR COMMUNITY

(L. C. Card No. Mic 60-6323)

Leonard Schatzman, Ph.D.
Indiana University, 1960

The aim of this thesis is to provide a conceptual model for the study of a specific type of disaster situation, one characterized by a destructive, physical force (tornado, earthquake, flash flood) which suddenly and unexpectedly strikes a settled population. "Disaster" is defined as a shared conception of events which emerges from social interaction among those who experience the new conditions of life.

The model is presented in the form of a natural history, with stages abstracted from the empirical events of a single, well-documented disaster incident. The stages depict a process whereby the new events are transformed from a collection of disparate, individual experiences into a collective representation and historical event in the life of the stricken area.

Four categories, representative of the natural process, are offered: (1) Induction--the manner in which persons first become aware, and part of, the disaster; (2) Movement--the spatial movement of the people after impact, and because of it; (3) Juncture--the meeting and interaction of persons with diverse experiences; (4) Transformation--the formation of a generalized collective conception of the events and its implications for the affected population.

The model presented in the thesis is juxtaposed to one employed historically and currently by disaster researchers in quest of a natural history. This is the "equilibrium model" which analogically attributes organic properties to social relationships. Social organizations are seen as organic systems. Thus, the primary research unit is the "social system" (usually community) and its fate in disaster is represented by the sequence of Organization, Disorganization, and Reorganization.

It is contended that this model and its sequence pattern, though valid, have marked limitations for the analysis of disaster behavior. These limitations include the failure to perceive or correctly interpret a number of important disaster facts. Behavior is observed and given meaning largely in terms of the extent to which it affects the social system. In contrast, our own focus of research is not upon the "restoration" of a social system, although restorative processes may be inferred, but rather upon the processes of disaster involvement, orientation, and the collective organization of disaster experience.

It is our contention (thesis) that a disaster sequence be abstracted from observed or reported disaster activities from the perspectives of the actors themselves, rather than from the perspective of the requirements of an assumed social system. In this way, we can observe the emergence of a "public" or universe of involvement. This public is a natural outgrowth of induction into disaster and subsequent social interaction. Community too is seen as emerging from the same process, with the expression of mutual identification through shared experience.

Thus, those who ultimately become involved in such a series of experiences, enter the "stream" of developing

disaster events at different times, in different ways and with different meanings and consequences. It follows that there is no disaster until something of the sort is experienced and defined collectively by the persons involved. The thesis is concerned with the way in which the initial fluidity of situations, definitions and groupings, was transformed into a community interpretation.

Microfilm \$2.75; Xerox \$7.80. 170 pages.

SOCIOLOGY, RACE QUESTION

THE ROLE OF THE MINORITY
COMMUNITY IN DESEGREGATION:
A STUDY OF LEADERSHIP AND POWER
IN A BIRACIAL SETTING.

(L. C. Card No. Mic 60-6977)

Margaret Elaine Burgess, Ph.D.
The University of North Carolina, 1960

Supervisor: Rupert B. Vance

This study is concerned with community centered power and race relations. The biracial community is seen as a dual system with an over-all organization and structure. The Negro community is then treated as a functional sub-community studied within the larger community aggregate. An urban center located in a state in the middle South, known as "Crescent City," was chosen as research site. While relevant data were obtained from both whites and Negroes, the investigation was designed as an intensive study of power and decision-making in the minority community as related to the dynamic issues attendant to the area of desegregation.

The search for minority leaders was begun by using the power attribution method for identifying power elites. Modified forms of the chain referral technique were used with Negro and white leaders; a stratified class sample of 283 respondents was obtained from the minority community. From the power attribution data the study moved to the tracing of decision and policy formation through an analysis of specific issues where Negro and white leadership was operative.

A significant association was found among the power attribution rankings of the sub-community poll, the Negro leader poll, and the white leader poll. This finding, along with others, illustrated the amount of communication and interaction present between Negro leaders and the broader community. The investigation showed, moreover, a significant relationship between the power attribution nominees and the active decision-makers.

Militant leaders have dominated the positions of minority power for the past decade. They work through the influential sub-community associations in setting strategy, and it is through these organizations that the lesser leaders and the articulate citizens have access to decision-making and the decision-makers. Those leaders most active in the school integration battle have also had a major role in the various political, economic, educational, and civic issues before the community. Particularly since the

Supreme Court decision of 1954 their bid for greater participation in the biracial community has been projected into a wide range of areas. The struggle against segregation has shifted from the narrower confines of the legal arena to the broader spheres of community life. All issues now bear on desegregation of the community. The minority power leaders are pressing for serious readjustments of Crescent City's power structure, and ability to raise community issues into the level of controversy has become a real source of power.

The actions of the top leaders have had the approval of a majority of Negro citizens. This was evidenced by the support leaders received in their various protest activities and in the verbal agreement found in the sub-community sample. Only 7.8 percent of the respondents expressed disagreement with the actions of their leaders.

The present study does not support a simple model of power. This would ignore the power potential of other organized minority groupings, the articulate citizens, and the very real problems associated with biracial community power. Structures of power are often dependent upon local conditions--history, tradition, institutional, and social characteristics. The facts from Crescent City's Negro community are evidence of the importance of these local variations. But the minority power leaders are attempting to mobilize the resources of the community for the attainment of goals which a general commitment has been made within American Society. And what has occurred here may be expected to occur in other biracial communities as Negroes gain additional "weapons" in their bid for a more strategic place in community power structures.

Microfilm \$3.80; Xerox \$13.30. 294 pages.

SPEECH-THEATER

AN ANALYSIS OF THE SPEECH OF CEREBRAL PALSIED INDIVIDUALS IN AN EFFORT TO DETERMINE EMPLOYABILITY LEVELS

(L. C. Card No. Mic 60-6659)

Jack Franklin Bensen, Ph.D.
The University of Florida, 1960

The purpose of this experiment was to ascertain whether there are any measurable factors of the audible communicative speech of cerebral palsied individuals which may be determinants of levels of employability, and if so, what those factors are.

Fifty adult cerebral palsied individuals were selected as subjects on the basis of availability only. Type of cerebral palsy, degree of physical impairment, and mental ability were not considered when selecting the subjects because this experiment was designed only to measure the effects of speech on employability.

The speech of each subject was tape recorded while responding to a picture articulation test and while reading ten of the Harvard Sentence Intelligibility sentences. Thirty-five personnel men listened to the recordings of the sentences and rated the subjects on a four point scale. The rating scale was as follows: 1. Would not employ, 2. Would employ for a job requiring little speech, 3. Would employ for a job requiring a moderate amount of speech, 4. Would employ for a job requiring a considerable amount of speech. The subjects were grouped into these four categories on the basis of a majority of the ratings of the personnel men.

Three speech pathologists listened to the tapes and scored the picture articulation test noting omissions, distortions, and substitutions. Articulation was scored by a number count of sounds misarticulated. The judges also rated the subjects' speech rhythm and quality on a four point scale ranging from normal to severely involved. Pitch was rated as normal, low, or high. Rate was measured by timing each subject while reading the sentences.

The results of the experiment show that articulation, rhythm, rate, and quality are significant at the .001 level of confidence as an over-all measure. Pitch was significant only at the .2 level of confidence as an over-all measure. Further analysis of the data shows that quality is a significant predictive measure between all groups, articulation and rhythm between all groups except between groups 3 and 4. Rate was significant as a predictive measure between all groups except between groups 2 and 3 and groups 3 and 4. Pitch was not significant as a predictive measure between any of the groups.

Therefore, taking into consideration the limited number of subjects, it may be said that such a set of rating scales as used in this experiment may be useful in ascertaining employability levels of cerebral palsied individuals as far as their speech is concerned. This, of course, should be accepted with the reservation of being substantiated by further research with a larger population.

Microfilm \$2.75; Xerox \$5.00. 99 pages.

AN ANALYSIS OF CERTAIN PSYCHOPHYSICAL PARAMETERS OF TINNITUS AURIUM

(L. C. Card No. Mic 60-6732)

James Tyson Graham, Ph.D.
Stanford University, 1960

For many hearing handicapped adults, tinnitus (head noises) is the most distressing aspect of their hearing problem. Even though the symptom of tinnitus is found in the majority of adults with hearing problems, there has been little published research dealing with its measurement. The purpose of the present study was twofold. First, an attempt was made to establish a series of psychophysical tests that would be adequate in measuring the acoustical characteristics of the symptom. Secondly,

several parameters were analyzed using these tests to determine if their measurement would permit the classification of tinnitus into meaningful subcategories.

A total of 100 subjects were tested in the study. On the basis of pure-tone threshold tests the subjects were divided as follows into four groups: sensorineural group--thirty subjects, mixed sensorineural-conductive group--twenty-five subjects, conductive group--twenty subjects, and normal group--twenty-five subjects. A battery of eight tests was administered to the seventy-five hard-of-hearing subjects to determine the frequency of their tinnitus, its loudness, and the effects of masking on the tinnitus. A battery of five tests was administered to the subjects who had normal hearing to determine the characteristics of any sounds they might perceive during a listening period in a heavily sound-treated room when no auditory stimuli were presented by the writer. The equipment used for the study included two standard clinical audiometers, an audio oscillator, and an input matching transformer for coupling the oscillator to either audiometer. A General Radio Sound Level Meter (Type 1551-B) was used to measure the ambient noise in the test room used for the normally-hearing subjects. The ambient noise level was lower than the minimum limits of the meter (24 db) on the "A" scale.

The results of the test batteries were analyzed by both logical and statistical inference. The findings failed to demonstrate group differences for the written descriptions made by the subjects of their tinnitus. The measurement of the frequency characteristics of tinnitus demonstrated a significant difference between the conductive hearing loss group and the other two hard-of-hearing groups. This difference was found to be a restriction of the frequency of tinnitus in conductive hearing loss to the frequency range below 1500 cps. No significant differences were found between the hard-of-hearing groups on the basis of the loudness of their tinnitus. The studies of masking were, in general, inconclusive. The final major finding of the study was a significantly smaller number of normally-hearing subjects experiencing tinnitus in the listening situation than would be predicted on the basis of previously published research.

From the results of this study, it can be concluded that audiological tests may be used effectively in further studies of tinnitus. It is also concluded that the descriptions made by individuals of the characteristics of their tinnitus are of limited value in furthering an understanding of the symptom. Microfilm \$2.75; Xerox \$5.60. 115 pages.

RELATIONS BETWEEN ORAL-PALATAL VARIABLES AND ARTICULATION RESPONSES OF CHILDREN REPRESENTING THREE AGE GROUPS AND FOUR TYPES OF CLEFT PALATE

(L. C. Card No. Mic 60-6292)

Robert Orville Grange, Ph.D.
Indiana University, 1960

The purpose of this study was to investigate some of the oral-palatal variables associated with post-operative cleft palate children. The variables included articulation, palatal adequacy, nasal emission, oral breath pressure, and extraneous facial movements.

A group of 60 children born with cleft palates and ranging in age from three to nine years was studied. The group was divided into three subgroups, each composed of 20 children within two-year age intervals. Each child was classified according to the four types of cleft palate described by Veau. Such groupings made it possible to study the variables according to age and type of cleft.

Measures of the variables studied were obtained through an articulation test involving 19 consonant sounds, manometer blowing, and nasal emission during speech and non-speech activities. Palatal adequacy and extraneous facial movements were evaluated after visual observation.

The results indicated that some subjects in each age group were judged to have palatal inadequacies of length and movement. Intactness was judged to be the most satisfactory palatal aspect in all age groups. The oldest group had the greatest number of subjects who were deficient in all aspects. No marked differences occurred when the subjects were grouped according to type of cleft.

The range of oral breath pressure for all subjects was considerable. Mean breath pressure increased with age, but did not show any marked relationship to type of cleft.

The measures of nasal emission used were significantly correlated. According to these measures, approximately one-third of all subjects had nasal emission, with the oldest group having the greatest number of subjects with emission. Nasal air emission tended to increase as the severity of the cleft at birth increased.

The adequacy of articulation increased with age and tended to decrease as the severity of the original cleft increased.

One-quarter of the subjects had extraneous facial movements with the youngest age group having the least number of subjects with such movements. The number of subjects with facial movements increased as the severity of the cleft increased.

Certain relationships were found between some of the variables studied. Nasal emission was not definitely related to the individual aspects involved in palatal adequacy, but when the aspects were taken as a whole, nasal emission was more evident in subjects judged to have palatal inadequacies.

Less nasal emission tended to occur with subjects who had greater oral breath pressure than with subjects who had lesser breath pressure.

Subjects with extraneous facial movements did not differ in regard to oral breath pressure from subjects without facial movements. However, a greater number of subjects with facial movements had a larger quantity of nasal emission than did not. Subjects with extraneous facial movements had significantly less adequate articulation than subjects without facial movements.

Articulation was not related to palatal adequacy or oral breath pressure, but was related to nasal emission, particularly in subjects with the less severe types of clefts at birth.

Microfilm \$2.75; Xerox \$9.00. 200 pages.

A HISTORY OF THEATRE
ARTS MAGAZINE: 1916-1948.

(L. C. Card No. Mic 60-5912)

John Guy Handley, Ph.D.
Louisiana State University, 1960

Supervisor: Professor Claude L. Shaver

Throughout its existence, from 1916 to 1948, Theatre Arts magazine was recognized as one of the finest theatre journals in the English speaking world. The periodical flourished during a time of revolutionary change in the American theatre. During the first half of the twentieth century, Theatre Arts magazine encouraged and reflected new artistic forms of scene design, the emergence of distinguished American drama by American playwrights, with a resulting change in audience tastes, and a strong movement toward the development of educational and community theatre throughout the country from which evolved new patterns of theatre architecture.

The purpose of this investigation is to analyze and to evaluate the first thirty-two volumes, 1916-1948, of Theatre Arts magazine in an effort to assess its significance; its impact on, and its contribution to, the theatre of its time. The first chapter considers the first seven years of the magazine, 1916-1923, when it appeared as a quarterly. The study determines the purpose in conception, the function and policy as a theatre journal, the trends and developments in policy and practice, and the growth and significance of the magazine. Analysis and evaluation is made of the editorial policy, the standard columns, the special features, the regular articles and the format of the magazine. The second chapter considers the twenty-two monthly volumes, 1924-1945, which comprised the major years in the existence of the magazine, under the editorship of Edith J. R. Isaacs. Concentration is on the magazine's adherence to its purpose, the maintenance of established standards, the trends and developments in editorial practice and policy and the impact of the journal on the theatre of its time. The procedure follows the same divisions as in chapter one. The third chapter analyzes and evaluates the final years of the magazine, 1945-1948, under the editorship of Rosamond Gilder. Analysis and evaluation is focused on the adherence of the magazine to the previously established purpose and standards and its policy, function and significance in the theatre of its day.

Theatre Arts magazine first functioned as a journal representative of the "new movement" in the theatre. A dynamic editorial policy advocated distinguished writing on the American theme by the American playwright; scenery that was simplified, appropriate and decorative, but above all contributive to a synthesis of all the arts of the theatre; and professionalization of the little theatre and experimental theatre throughout America as true art and community theatre projects. With the emergence of the scene designer, the playwright and the director, all representative in some degree of the ideas expressed in the early volumes, Theatre Arts reached in the mid-nineteen-thirties its peak of development as a progressive magazine devoted to the idea of theatre as an art. Editorial policy evidenced less rebellion against and more of a reflection of the theatre of its time. Discerning criticism continued, and editorial advocacy turned to new fields such

as theatre architecture and the establishment of a National Theatre. During its final years Theatre Arts magazine reflected more than before a simple review approach to the theatre of the period.

Flourishing as it did in the most revolutionary period in the history of the American theatre, Theatre Arts magazine for thirty-two years, 1916-1948, proclaimed the importance and dignity of the American theatre. Much of the leadership in the creation of this distinguished American theatre sprang from the persistent devotion of Theatre Arts magazine to theatre as an art.

Microfilm \$4.25; Xerox \$14.85. 330 pages.

THE RELATIONSHIP BETWEEN
SPEECH-SOUND DISCRIMINATION
ABILITY AND ARTICULATION OF
THE [S] PHONEME

(L. C. Card No. Mic 61-49)

David M. Luterman, Ed.D.
The Pennsylvania State University, 1960

Almost all research in the area of speech-sound discrimination ability has been directed toward determining whether a group of articulatory defective individuals differ from a group of normal-speaking subjects in their ability to make speech-sound discriminations. Very little research has considered the question of how varying degrees of discrimination ability are reflected in the articulation of the defective child. The present study was directed toward examining the relationship between speech-sound discrimination ability as measured by an interphonemic and intraphonemic test of discrimination and the consistency of misarticulation, type of articulation, and chronological age, respectively.

An 85-item test composed of 15 distortion items (intra-phonemic) and the 70-item Templin test (interphonemic) was used to measure the speech-sound discrimination ability. The distortion items were composed of five simulated distortions of the [s] phoneme. These represented five degrees of distortion as determined by five experienced judges. Each distortion was paired with itself and with every other distortion to comprise the 15 items of the test. The Templin items and the distortion items were recorded by the same speaker with the position of the intraphonemic items determined randomly. The test was presented to the subjects twice to determine test-retest reliabilities.

The combined test was administered to 40 functional articulatory [s] defective subjects, of whom several also misarticulated the [z] but none misarticulated any other phoneme. All subjects had at least normal intelligence, were above eight years of age, and had an articulatory defect functional in nature. Subjects were selected on the basis of therapist referral and examination by the investigator. All subjects were given a 70-item deep test for the [s] phoneme.

The results of this study indicated that there was a relationship between consistency of misarticulation and discrimination ability as measured by the tests used in this study. A significant relationship was found between the predominant type of misarticulation and discrimination

ability on the interphonemic test; subjects with a relatively greater proportion of distortion errors tended to make less errors on the interphonemic test than subjects with a relatively greater number of substitution errors. This relationship was found despite certain noted inadequacies in the classification of articulatory errors as "distortions" and "substitutions" for use as indicators of phonemic approximation. Chronological age correlated significantly with performance on both discrimination tests: older subjects tended to make less errors than younger subjects. This finding was interpreted to suggest that delayed maturation of discrimination ability may be of etiological significance for some articulatory defective children. The interphonemic and intraphonemic tests were found to be comparable measures of speech-sound discrimination ability despite the fact that the interphonemic test contained few items requiring the discrimination of the phoneme that the subjects misarticulated.

Microfilm \$2.75; Xerox \$4.80. 94 pages.

BERNARD SHAW'S STAGE DIRECTIONS

(L. C. Card No. Mic 60-6572)

Omar Martin Paxson, Ph.D.
Northwestern University, 1960

At the turn of the century Bernard Shaw's plays were relatively unknown in England and seldom produced there even though in America and Germany many of his works had proved successful. In order to reach a larger audience in his own country he began to court the reading public. It had been the custom of his contemporaries to load their plays with stage directions addressed to the actor and couched in the special jargon of the theatre rather as if they expected no one to read a play except as a guide to production. Shaw, in contrast, concentrated upon making his plays attractive in print, first by omitting technical descriptions likely to dull the interest of the casual reader, and then by providing interesting descriptions of locales, characters and actions. Gradually this practice led him to the creation of those highly readable stage directions which were to become one of the most distinguishing innovations of his printed plays.

As Shaw the playwright grew in experience he developed his stage directions to serve a variety of ends. To his original purpose of interesting the reader he added another, to tell the actor what specific stage business should heighten his performance, and ultimately another yet, to help the performer and the stage director to fix the correct interpretation of the work in specific vocal style.

This dissertation treats the stage directions from two angles of approach, the first being an attempt to describe the nature and function of the various directions and the second an attempt to define the relationship of the directions to the individual creative efforts of the actor, stage director, and theatre technician. The first approach reveals that Shaw's directions, while predominantly novelistic in nature and frequently non-theatrical in style, are designed to instruct the producer as well as to interest the reader. In general, when considered as technical notes, the directions are detailed, precise, and consistent.

Upon considering the relationship of the directions to the creative work of the artist, it becomes clear that Shaw has very definite ideas as to the style of acting and mode of staging with which he wants his plays to be done. The style of acting which he favors is indisputably flamboyant. The staging he envisions is quite conventional but worked out completely down to the most minute details of position and movement. Stage lighting he sees mainly as a means of simulating realistic sunlight, firelight, moonlight, and lamplight. His directions as to color effects are characterized by dependence upon rather strong hues with a distinct predilection for red as a means of centering attention.

Shaw's stage directions have, however, a value far beyond utility. Many of them are as interesting in themselves as the actions which they describe. At the very least it is abundantly clear that Shaw in his directions has given to theatrical practitioners an assistance which no producer can afford to neglect.

Microfilm \$3.40; Xerox \$11.95. 264 pages.

THE SUBJECTIVE PERSPECTIVE; ASPECTS OF POINT OF VIEW IN MODERN DRAMA.

(L. C. Card No. Mic 60-5928)

August William Staub, Ph.D.
Louisiana State University, 1960

Supervisor: Professor Claude L. Shaver

When late 19th-century Romanticist thinking culminated in modern individualism, there resulted a philosophic shift from universal objectivity to individual subjectivity, from absolute morality to relative morality. Artists wishing to express the new philosophy had to search out fresh methods of presenting their material. Writers of fiction realized that the traditional omniscient approach to the problem of rendering unspoken thought was no longer acceptable, since omniscience rested its argument on the concept of universality, whereas Relativism demanded a concern with the question of point of view. Moreover, the new science of psychoanalysis soon conceived of man as governed chiefly by his most primitive, irrational impulses. Consequently, the problem of point of view became the problem of rendering not only the individual's consciousness but also his metaconscious states as well. Thus, the concern with point of view also became the concern with the convention of stream of consciousness, that is, with a convention capable of expressing a totally subjective perspective.

After the novelist Henry James clearly articulated the problem, a number of striking experiments with point of view in general and stream of consciousness in particular, came from such novelists as Proust, Joyce, and Faulkner. So striking were these experiments that some students of the novel have assumed that the problem is indigenous only to fiction. Actually, the issue of point of view is basic and vital to the whole concept of Relativism, and in appropriately altered form it stands as the essential question of most modern arts.

It is the purpose of this study to demonstrate that point of view, or the subjective perspective, is the primary and

most distinctive feature of modern dramaturgy. To support this contention, the development of modern drama is presented as paralleling that of the modern novel. Like Zola and Flaubert in fiction, Ibsen first attempted to present his Relativism through third-person dramatization, but when this approach failed to satisfy him, Ibsen tried to pierce third-person objectivity with symbolism. That he was not totally successful in his attempt did not keep his younger contemporary Strindberg from completely discarding third-person in favor of first-person dramatization. After Strindberg had stated the problem, many important dramatists followed him in exploring and exploiting the subjective perspective.

This study investigates eight significant point-of-view experiments in drama. Strindberg's *The Dream Play* and Evreinov's *The Theatre of the Soul* are presented as early statements of the issue. Kaiser's *From Morn to Midnight* and Pirandello's *Six Characters in Search of an Author* are offered as plays concerned with point of view because their themes centered about the concept of the disappearing ego. O'Neill's *Strange Interlude* and Giraudoux's *The Madwoman of Chaillot* are studied as solutions drawing upon older dramatic techniques. Finally, *Death of a Salesman* by Miller and *The Waltz of the Toreadors* by Anouilh are presented as representative of recent trends toward compromise.

Viewed in terms of method, modern drama need not be considered as a mass of conflicting and confusing "ism's," for it consists, briefly, of two broad, interrelated directions, both of which share a common romantic background. The first direction, popularly called Realism, is based on a third-person objective dramatization; the second direction, a later stage and consummation of the first, is that of first-person subjective dramatization. For identification, the two directions may be labeled Externalism and Pan-psychism. Pan-psychism, the more subjective and irrational direction, had tended toward deep pessimism. This pessimism apparently touched bottom with Pirandello, for recent point-of-view dramas have tended to compromise with approaches involving saner and more lucid subject-object relationships.

Microfilm \$3.85; Xerox \$13.50. 299 pages.

AN INVESTIGATION INTO ABBREVIATED CLINICAL PROCEDURES FOR HEARING AID EVALUATIONS

(L. C. Card No. Mic 60-6972)

Donald Gray Williamson, Ph.D.
Michigan State University, 1960

Major Professor: Max Nelson

The purpose of this study was to determine if competent hearing aid evaluations can be done using only the Speech Reception Threshold (SRT) and the Speech Reception Discrimination (SRD) data.

There were four different groups of ten subjects each who were given two hearing test batteries about one week apart. The subjects were 30 males and 10 females ranging in age from 18 to 81 years, with a mean age of 39.45 years.

The tests administered were:

1. The usual battery given at the Michigan State University Hearing Clinic consisting of pure tone air and bone conduction tests, the SRT, and the SRD. This battery is known as the "Long Form."
2. An abbreviated form of the above consisting of the SRT and the SRD only. This is known as the "Short Form."

These two batteries were combined in all possible ways to expose each subject to two experimental situations.

The statistical analysis employed the Spearman Rank-order correlation coefficient to determine the degree of relationship between the Long and the Short Forms and the "t" test to obtain the degree of significance of the lowest correlation found. Following this, an observational analysis of the data was conducted to determine the consistency of the hearing aid strength and the ear choice over the two testing situations. A validity verification was also done on 64 cases chosen from the Hearing Clinic files. The hearing aid strength was determined by two judges working independently using only the speech reception data from these 64 cases.

The results of this indicated that there was a good correlation between the Long and the Short Forms. The lowest correlation was .69.

The observational inspection of the data over the two tests which were given to each subject resulted in the same strength hearing aid being recommended for each subject on both tests. The choice of the ear upon which to put the hearing aid showed only five differences. The differences noted were all between a monaural or a binaural selection and not between each individual ear.

The validity verification resulted in only two differences of opinion between the two judges. These differences were noted in the recommendation of a moderate strength hearing aid when the original recommendation and the other judge recommended a weak hearing aid. These differences were seen in subjects whose SRT scores were on the borderline between the two classifications. The other classifications; no hearing aid, moderate hearing aid and strong hearing aid, exhibited perfect agreement between the two judges.

It can be concluded, within the limitations of this study, that effective hearing aid evaluations can be done with the elimination of the pure tone testing, providing the same clinical procedures and principles are followed as in this study.

Microfilm \$2.75; Xerox \$6.00. 125 pages.

A STUDY OF THE COMMUNICATION COURSE IN SELECTED COLLEGES AND UNIVERSITIES IN THE UNITED STATES

(L. C. Card No. Mic 60-6589)

Norman Carl Ziemann, Ph.D.
Northwestern University, 1960

The purpose of this study was to investigate current practices in the communication course. The general education movement has brought about considerable attention

to courses in communication skills, these courses having been developed to replace traditional courses in English composition.

Two major methods were used in gathering descriptive material for the study. First, a questionnaire was devised to collect data concerning current practices and, secondly, syllabi of courses were collected and examined to provide information.

As no current list of schools offering the course existed, a new list was compiled by sending a letter to schools inquiring if they offered the course and would participate in the study. This letter was sent to 1275 accredited schools, resulting in 923 replies, with 305 of these schools indicating they offered the course. An examination of the questionnaires resulted in the acceptance of data of 85 schools for the study, their courses meeting the definition of a communication course as a single integrated course including three or more of the communication skills, including the skill of speaking.

Pertinent conclusions are presented under five major headings. 1. Administration and instructional staff: Although the course is administered under a variety of units, English departments are usually in charge; English departments and administration of schools are major originators of the course; the majority of instructors have their training in English or speech, with more in the field of English; the average class load of communication instructors is similar to that of all instructors; and most schools prefer one instructor per section to two or more. 2. Basic information about the course: There is little uniformity in assigning titles to the course; most titles indicate emphasis on training in communication skills; the course is an integral part of the general education movement; the most common objectives are development of

skill in reading, writing, speaking, and listening; the course is usually a year in length; approximately as many schools require a further English course as those that do not; most schools do not require a further speech course; and there is no established policy regarding granting credit for the course for a major or minor in English or speech. 3. Selection and retention of students: The course is usually offered in the freshman year; most schools do not have plans permitting total or partial exemption from the course; although standardized tests are used for evaluation, departmental devised tests are usually used; and the majority of schools do not section students according to ability and/or need. 4. Content and method: The skills of listening and speaking receive less emphasis than the other two communication skills; training in listening is not as well-defined as the other skills, much being done without specific assignments; most schools utilize several textbooks rather than one basic textbook; many schools permit much flexibility in following a course syllabus; and little has been done in providing special classroom equipment or arrangements for teaching the course. 5. Reactions to the course: Although there is some dissatisfaction with the results of the course, most instructors prefer the integrated approach; many schools are contemplating changes in the course in attempts to develop a more satisfactory course; a few schools are abandoning the course for separate courses in English and speech; most schools desire instructors with training in both English and speech rather than specialized training in one field; many schools have difficulty in finding trained and interested instructors; and most schools find other departments have a co-operative attitude toward the course, although some are apathetic and a few hostile.

Microfilm \$3.15; Xerox \$11.05. 241 pages.

ZOOLOGY

SYSTEMATIC REVISION OF THE
GENUS *EPHEMERELLA* OF WESTERN
NORTH AMERICA (EPHEMEROPTERA:
EPHEMERELLIDAE), INCLUDING SOME
EASTERN NORTH AMERICAN SPECIES.

(L. C. Card No. Mic 60-6219)

Richard Knapp Allen, Ph.D.
University of Utah, 1960

Chairman: George F. Edmunds, Jr.

This dissertation constitutes a systematic revision of the North American species of the mayfly genus *Ephemerella*, except for the subgenera *Eurylophella* and *Ephemerella* s. s., where only the western species were treated. Each species is named and characterized and the application of the names proposed in the genus have been determined. Adequate illustrated keys are given for subgenera, species and subspecies. The geographic range of each species has been determined, with distribution maps given for all western species. Individual and geographic variation

has been studied in detail for the western species, especially for the three polytypic western species. General biology and habitat notes are given for many western kinds.

Of the 101 names that have been applied to the North American species of the genus, fourteen were placed in synonymy prior to this study. Edmunds and Allen (1954) eliminated three more by declaring *E. consimilis* Walsh, *E. quebecensis* (Provancher), and *E. unicornis* Needham as *nomina dubia*. This study has further reduced the number of names by discovery of the following synonymies: *Ephemerella teresa* Traver (= *cognata* Traver), *E. heterocaudata* heterocaudata McDunnough (= *columbiella* McDunnough), *E. coloradensis* Dodds (= *wilsoni* Mayo), *E. flavilinea* McDunnough (= *lapidula* McDunnough), *E. spinifera* Needham (= *autumnalis* McDunnough, *sierra* Mayo), *E. attenuata* McDunnough (= *hirsuta* Berner), *E. grandis ingens* McDunnough (= *flavitincta* McDunnough, *glacialis* Traver, *proserpina* Traver), and *E. ingens* McDunnough is reduced to a subspecies of *E. grandis*. Four species, *E. cornutella* McDunnough, *E. maculata* Traver, *E. depressa* Ide, and *E. molita* McDunnough need further study to determine their validity. The names *Ephemerella plumosa* Morgan and *E. spinosa* Morgan nec Mayo are *nomina nuda*.

The number of species has been increased by the addition of published descriptions of *E. berner* Allen and Edmunds, 1958, and *E. edmundsi* Allen, 1959, during the study, and the descriptions of four additional species in this dissertation. The North American species of the genus *Ephemerella* thus numbers seventy-two.

Three western North American species, *Ephemerella grandis* Eaton, *E. hecuba* Eaton, and *E. heterocaudata* McDunnough, are polytypic. *Ephemerella hecuba pacifica* Allen and Edmunds, 1959, has been published, and two new subspecies of *E. heterocaudata* are described in this dissertation.

Relationships of the subgenera of *Ephemerella* were determined by a study of nymphal and adult characters assumed to be of phylogenetic significance, and the most closely related forms were placed in proximity to one another.

The distribution of the species of *Ephemerella* indicates that the genus is of a northern origin, and the western species are segregated into three general distributional patterns which indicate two probable routes of dispersal of the species, one through the Coast Ranges and Cascade Mountains and one through the Rocky Mountains.

Past climatic conditions, discontinuous distribution, and relative abundance of species appear to have been important factors determining subspeciation.

Microfilm \$4.15; Xerox \$14.65. 323 pages.

TAXONOMY, DISTRIBUTION, AND BIOLOGY OF THE DYTISCIDAE OF UTAH.

(L. C. Card No. Mic 60-6220)

Russell Daniel Anderson, Ph.D.
University of Utah, 1960

Chairman: George F. Edmunds, Jr.

The dytiscid beetle fauna of Utah consists of eighty species, disposed in twenty genera. Nineteen of the species made known in this study are new state records, with six of these (i.e., *Hydroporus fuscipennis* Schaum, *Hydroporus niger* Say, *Oreodytes scitulus* (LeConte), *Oreodytes septentrionalis* (Gyllenhal), *Agabus verisimilis* Brown, and *Agabus bjorkmanae* (Hatch) being range extensions of approximately eight hundred miles. Two of the genera (viz. *Eretes* and *Coptotomus*) were previously unreported for Utah.

The account of each species includes: (1) a detailed reference to the literature pertinent to Utah species, including a taxonomic review; (2) detailed description of the adults with drawings of the male genitalia of all species for which males could be obtained; (3) the type locality and the disposition of the type; (4) the species distribution in Utah with a statement of relative abundance; (5) description of the habitat, giving such available data as velocity, depth, bottom type, amount of vegetation, temperature, hydrogen ion concentration, dissolved oxygen content and free CO₂ content; and (6) notes on the seasonal occurrence of larval and adult stages, copulation, dates of emergence from the pupal chamber, and other aquatic organisms with which the species most often are associated.

An original key for the genera of the Utah Dytiscidae is

presented and keys are given to determine the adults of all species found in Utah in which the genus has more than one species occurring in Utah.

A comparison of the dytiscid fauna below 5,500 feet in elevation in Salt Lake and Utah Counties was made to determine if extended mosquito control procedures were having any appreciable effect on the numbers of species of Dytiscidae present. It was shown that after more than thirty years of mosquito control operation in Salt Lake County, and no organized mosquito control in Utah County, the two counties have thirty-one species in common. This represents 38.7 per cent of all the species in the state and 95 per cent of the species in northern Utah below 5,500 feet. The study areas in Utah County had three species which were not collected in Salt Lake County. *Hydroporus despectus* Sharp and *Hygrotus masculinus* (Crotch) have been collected only along the margins of Utah Lake which probably provides the particular habitat needed by these species. *Thermonectus basillaris* (Harris) was also collected in Utah County but not in Salt Lake County, and *Hydaticus modestus* Sharp was collected in Salt Lake County but not in Utah County. These two species are extremely rare members of the dytiscid population and may have been overlooked during collecting in the other county. Due to the great similarity and slight disparity of the dytiscid fauna, it is probable that mosquito control operations have not modified the numbers of species of Dytiscidae present in Salt Lake County. Four factors are hypothesized to explain the ability of the dytiscids to maintain themselves under organized mosquito control. These are: (1) numerous nonmosquito producing habitats, which remain untreated, continually add new members to the populations; (2) the high reproductive rate of the dytiscids tends to overpopulate untreated areas, so that many of the beetles killed by mosquito control procedures might possibly represent excessive individuals that would not survive anyway; (3) the ability to fly allows for a wide dispersal of the various dytiscid species within their geographic range; and (4) following the application of the insecticide a state of hyperactivity results and the beetles may leave the treated area, and might possibly survive in an untreated habitat.

Four faunal origins and dispersal patterns are proposed to account for the dytiscid fauna of Utah: (1) high latitude species which apparently have moved south along the mountains during the advances of the Pleistocene ice sheet; (2) low latitude species which have entered the area through the Colorado River drainage and have established themselves in the lower elevations of the state; (3) cosmopolitan species which are widespread in distribution and ecological tolerance and may have entered from one or more of several directions; and (4) endemic species (e.g., *Hydroporus transpunctatus* Chandler, and *Hygrotus virgo* (Fall) which may have had their origin within the state of Utah as evidenced by their very localized ranges.

Microfilm \$4.20; Xerox \$14.85. 327 pages.

ECOLOGICAL RELATIONSHIPS ASSOCIATED
WITH DECREASING GROWTH RATE OF
CLEAR LAKE YELLOW BASS

(L. C. Card No. Mic 61-439)

Marvin Meryle Buchholz, Ph.D.

Iowa State University of Science and Technology, 1960

Supervisor: Kenneth D. Carlander

The average size of adult yellow bass in Clear Lake, Iowa decreased in recent years to the extent that few were acceptable to fishermen in the late 1950's. Age and growth determinations were made from scales of 2,611 yellow bass collected from Clear Lake by biologists of the Iowa Cooperative Fisheries Research Unit from 1952 through 1958. Because the 1950 and 1951 year classes were known to be missing, it was possible to demonstrate that members of the 1949 year class had failed to form annuli in 1955 and 1956. Members of the 1949 year class also failed to grow or to form annuli in 1957 and 1958. Evidence from the analysis of length-frequency data and from the comparison of back-calculated lengths at each annulus showed that other year classes also failed to grow or to form annuli in some years. Resorption of scales was associated with the failure in growth. The mean length at capture decreased in several successive years for the 1946, 1948 and 1949 year classes.

Year classes varied greatly in strength from 1946 to 1957. A significant correlation was obtained between spring temperature and abundance of the resulting year class. Warmer than average temperatures in April and May probably result in earlier spawning dates and, thereby, result in stronger than average year classes.

The Hile index to the growth of the yellow bass indicated growth was better than average in 1947, 1948, 1949, 1950, 1951 and 1953, and poorer than average in 1952, 1954, 1955, 1956 and 1957. Growth was best in 1951 and poorest in 1957. The average condition factor of larger yellow bass declined from 1952 to 1958. Both growth and condition of yellow bass were better in years of high water and poorer in years of low water. The correlation coefficient between yellow bass population density and condition of larger yellow bass was significant, but the correlation coefficient between population density and growth index was not.

Odonata were important food forms for yellow bass in 1941-1942, but were not important in their diet in 1957-1958. Although *Hyaella* and Cladocera were the most important crustaceans during both periods, there was more dependence upon Cladocera and less upon *Hyaella* in 1957-1958 than in 1941-1942. No general reduction in numbers of small forage fish was demonstrated over the period of decreasing growth rates, but utilization of fish as forage decreased. Excess forage fish were provided 10 yellow bass kept in the lake in nylon bobbinet pens for about six weeks in 1959. These fish grew well, increased their weight by about 33 percent and showed an increase in blood protein, while those of comparable size in the lake were growing very little, if at all.

The decrease in growth rate of Clear Lake yellow bass from 1951 to 1958 was thought to be the result of a reduction in abundance of larger invertebrate food forms and increased competition for all food forms. The growth of

yellow bass did not appear to be related to the amount of space available per fish.

Microfilm \$2.75; Xerox \$5.80. 118 pages.

A CYTOLOGICAL STUDY OF
GAMETOGENESIS IN THE FROG LUNG FLUKE,
HAEMATOLOECHUS MEDIOPLEXUS
(TREMATODA: PLAGIORCHIIDAE).

(L. C. Card No. Mic 60-6978)

Paul Ray Burton, Ph.D.

The University of North Carolina, 1960

Supervisor: C. Dale Beers

Spermatogenesis in *Haematoloechus medioplexus* is of the rosette-type, with the dividing cells remaining attached to each other by a short cytoplasmic stalk. Three spermatogonial and two spermatocyte stages occur, with the terminal rosette consisting of 32 spermatids. The centriole has been followed throughout the process and was found to divide visibly only during metaphase of the first meiotic division. Four centrioles are thus seen in a primary spermatocyte, two at each pole, and each member of a pair participates in the division of the cell.

The secondary spermatocytes receive two centrioles which form the centers for the subsequent division. Division of the secondary cells gives rise to a rosette of 32 spermatids, each containing a single centriole.

A spermatid differentiates into a very long and filamentous sperm, during which the single centriole increases in size and apparently acts as an organizing center. The cytoplasm of the spermatid grows out from the region of the centriole in the form of a filament. Only a part of the granular mitochondria enters into the formation of the sperm. The 32 sperm leave behind a residual cytoplasmic mass which is vacuolated and contains the remaining mitochondria.

A fully-formed sperm is differentiated into a short acrosome, a shaft of chromosomal material (head), and a tail consisting of a long middle piece and an undulating terminal piece. The developed sperm measures about 400 μ .

Oogenesis begins in the ovary and proceeds to the diplotene stage. At the onset of diplotene the chromosomal threads become less basophilic. The oocyte remains in this condition until penetration of the filamentous sperm head, whereupon the diplotene chromosomes regain their basophilia and the process of oogenesis is resumed. The sperm shortens and becomes less compact as two polar bodies pass out of the oocyte cytoplasm. Pronuclei then form and, after a brief period of rest, fuse to give rise to the cleavage nucleus.

The nucleoli of the older oocytes within the ovary undergo a process of extrusion, whereby small, iron-haematoxylin staining bodies are released from the nucleoli and pass through the nuclear membrane into the cytoplasm. In the cytoplasm they aggregate to form a few large bodies which remain until sperm penetration, when they disappear.

The chromosomes of this species appear as short rods when fully condensed, and there are 22 in a diploid set.

Microfilm \$2.75; Xerox \$3.80. 68 pages.

POSTEMBRYONIC DEVELOPMENT OF
THE MESOSOMA AND WINGS OF THE
HONEYBEE, *APIS MELLIFERA* L.
(HYMENOPTERA: APIDAE).

(L. C. Card No. Mic 61-274)

Howell Vann Daly, Jr., Ph.D.
University of Kansas, 1960

The purpose of this thesis is to provide a description of the transformation of the skeletal and muscular systems of the larval mesosoma into those of the adult bee. A large part of the suprageneric classification of the Hymenoptera rests on the venational and sutural patterns of the wings and mesosoma. Numerous authors have assigned certain morphological and taxonomic values to these structures, although most have relied exclusively on the comparison of adults.

The honeybee was selected for this investigation since the developmental stages are easily procured and the insect is already the subject of many useful studies of ontogeny. Mature larvae, pupae, and adults were killed in a variety of fixatives. Hot Bouin's solution gave specimens best suited for dissection and for serial sections. Mayer's Hemalum and Eosin Y were used as stains. In order to provide a means for comparison with other species of bees, many of which are irregular in chronology, changes in external features and in pigmentation were used as criteria for development.

The postembryonic origin of integumental characters frequently used by taxonomists is established. Arguments are given for the existence of an indefinite external area of sternum. The subpleural signum is shown not to be homologous with the sternopleural suture. The recognizable parts of the pleural sutures of the pterothorax are shown to include only the vertical sulci paralleling the posterior margins of the pleurae.

The veins of the wing are indicated as lacunae prior to the presence of tracheae or nerves. The tracheation of the wing is reduced, but homologous with that found in other Hymenoptera at a comparable level of development. No comparisons with the venation of other insects were attempted.

The fate of the larval musculature and the origin of the imaginal musculature is traced in detail, including complete descriptions of the system for the larva, pupa, and adult. A majority of the larval muscles are destroyed at metamorphosis and most of the imaginal muscles are formed from independent aggregations of myoblasts. Morphogenesis of the imaginal skeleton during the pharate pupal stage is accompanied by simultaneous changes in the sizes and positions of muscles. This phenomenon is also seen in the pharate adult of Odonata, hence the pupa of the Endopterygota should represent the first of two imaginal instars. Other evidence supports the hypothesis that muscles are directly or indirectly significant as mechanical forces in the initial formation of most skeletal features of the mesosoma. Creases in the body wall may develop into articulations or continue as sulci. A sulcus may not indicate an ancestral articulation, hence is not necessarily a true suture in a phylogenetic sense. In the pharate adult, the muscles undergo a second change, increasing in size and often shifting their origins relative to the skeleton. During this stage the furcal arms and the second phragma continue to grow, completing the internal skeleton.

Microfilm \$2.75; Xerox \$6.80. 145 pages.

FISH POPULATIONS OF THE NEOSHO
AND MARAIS DES CYGNES RIVERS, KANSAS,
FOLLOWING DROUGHT.

(L. C. Card No. Mic 61-275)

James Everett Deacon, Ph.D.
University of Kansas, 1960

This study was conducted in 1957-1959, immediately following the driest five-year period of record in Kansas, to determine the ability of fish populations in the Neosho and Marais des Cygnes rivers, Kansas, to readjust to continuous stream-flow.

Fifty species were taken in the main stream of the Neosho River. This river has a greater diversity of habitats (more riffle area, more gradient, more gravel bottom) than does the Marais des Cygnes River, where 39 species were taken in the main stream.

The faunas of the two rivers show a wide range of adjustment in response to marked environmental changes. As these rivers become low and clear they assume many faunal characteristics of smaller tributaries and ponds. *Ictalurus melas*, *Micropterus punctulatus*, *Micropterus salmoides*, *Pomoxis annularis*, *Notropis lutrensis*, *Notropis rubellus*, *Notropis camurus*, *Notropis volucellus* and *Noturus exilis* assume a more prominent position in the total population. *Ictalurus punctatus*, *Pylodictis olivaris*, *Aplodinotus grunniens*, *Cycleptus eleongatus* and such riffle-dwelling species as *Hybopsis x-punctata*, *Noturus* sp. (Neosho River madtom), and *Percina phoxocephala* hold a less prominent position in the total population.

When permanent flow is re-established the more mobile and the more generalized species (with respect to habitat) are able to utilize the available space immediately. Their rapid increase in abundance occurs both by movement from more permanent waters and by reproduction. *Ictalurus punctatus*, *Pylodictis olivaris*, *Aplodinotus grunniens*, *Carpiodes carpio* and probably *Lepisosteus osseus* are mobile species. Individuals that move supplement those that survive in residual pools, and provide brood stock adequate to produce a large year-class in the first year of permanent flow.

The five species last mentioned are found in diverse kinds of streams, indicating that they are adaptable to varying habitats. A sixth species, *Notropis lutrensis*, though probably less mobile, is able to utilize opportunistically nearly any kind of habitat in plains streams. Although this species is seldom abundant in riffles, it was, in 1957, abundant in both pool and riffle situations at my six stations on the Neosho and Marais des Cygnes. These riffles were almost unoccupied by other species in 1957 until mid-summer, when hatches of *Ictalurus punctatus* and *Pylodictis olivaris* occurred. Although adults of these two species live well in pools, the young mainly occupy riffles. This age- and size-segregation, in different habitats, was an advantage to the rapid re-establishment of these species in the Neosho and Marais des Cygnes rivers in 1957.

Species that occupy restricted habitats, especially riffle-dwellers such as *Noturus* sp., *Hybopsis x-punctata* and *Percina phoxocephala*, were slowest to increase following drought. These species seem less capable of adapting to the variable conditions prevalent in the Neosho and Marais des Cygnes rivers than species that have more generalized habitat requirements; however, nearly all species that were found in years just prior to the

drought of 1952-1956 were again found in the last year of my survey.

Suckers, minnows and catfishes constitute the main fauna of the Neosho and Marais de Cygnes rivers, because these families contain many species that have generalized habitat requirements. Many of these fish are able to live successfully in either ponds or flowing waters and others are capable of long migrations.

Microfilm \$2.75; Xerox \$6.20. 129 pages.

STUDIES ON THE RELATIONSHIP OF
MACROPHAGES TO THE DEVELOPMENT OF
MELANOPHORES IN *TARICHA TOROSA*
WITH SPECIAL REFERENCE TO PIGMENT
CHANGES AT METAMORPHOSIS

(L. C. Card No. Mic 60-6728)

James Thayer Duncan, Ph.D.
Stanford University, 1960

The development of the large complement of epidermal melanophores that appears during metamorphosis in *Taricha torosa* has been carefully observed, and the histories of many individual cells have been traced. Special attention was given to the possible transformation into epidermal melanophores of phagocytic cells following the ingestion of melanin debris liberated by disintegrating dermal melanophores. Extensive observations on normal metamorphosing larvae yielded no case of melanophage transformation; neither were any instances observed of the migration of dermal melanophores into the epidermis to form epidermal melanophores. Apparently all epidermal melanophores develop by the differentiation of unpigmented cells or by the mitoses of these newly differentiating cells.

The problem of melanophage transformation was also attacked experimentally by supplying host macrophages with melanin debris in several ways. Living melanophores have been mechanically disrupted *in situ*; killed melanophores, obtained from neural crest cultures, have been implanted into melanophore-free locations on the flank skin of larvae whose trunk neural folds had been removed in early embryonic stages; and melanophage-laden liver tissue from recently metamorphosed larvae has been implanted under the same conditions. In addition, live melanophores from neural crest cultures have been implanted into melanophore-free skin areas. In no case following the experimental formation of melanophages was any instance of the transformation of a melanophage into a melanophore observed. On the other hand, in more than half of the cases in all of these experimental treatments, melanophores were observed to differentiate in the immediate neighborhood of the experimental location, but they developed from unpigmented cells that contained no ingested melanin debris. However, their differentiation appears to be dependent upon the presence in their vicinity of the free contents of disrupted melanophores.

It is concluded that: 1) The transformation of melanophages into melanophores is extremely rare, if, indeed, it ever occurs at all. Thus this phenomenon cannot be a significant source of epidermal melanophores in normal development. 2) The migration of dermal melanophores into the epidermis cannot account for the formation of

epidermal melanophores. 3) The large population of epidermal melanophores, which appear primarily during metamorphosis, develops by the differentiation of unpigmented, migratory cells originally derived from the neural crest and by division of these newly differentiating cells.

Furthermore, it is proposed that some constituent of the disintegrating melanophores is possibly able to stimulate undifferentiated cells of neural crest origin to develop into melanophores when they otherwise might not have. The extensive breakdown of dermal melanophores during the metamorphosis of normal animals provides melanophore material for this stimulus. Thus the dermal melanophore breakdown may after all make a positive contribution toward the development of epidermal melanophores during metamorphosis, not in the sense of inducing cell transformations but rather by stimulating the differentiation of previously uncommitted neural crest cells.

Microfilm \$2.75; Xerox \$5.40. 106 pages.

SOME ASPECTS OF THE NATURAL HISTORY
OF *STENOBRACHIUS LEUCOPSARUS*
EIGENMANN AND EIGENMANN

(L. C. Card No. Mic 60-6729)

Thomas Normand Fast, Ph.D.
Stanford University, 1960

During the years 1951 through 1955 a series of weekly hydrographic stations and plankton samples were made to 1000 m at a single position in Monterey Bay, California, 36° 42' N. 122° 02' W. The biological samples yielded over 4000 specimens of *Stenobranchius leucopsarus*, which is the dominant planktonic fish. From both physico-chemical and biological data some factors of the natural history of this species have been elucidated: the larval forms have been described, the growth and maximum age determined, the seasonal and vertical distributions characterized, and the influences of varying physico-chemical factors upon such distributions determined.

The descriptions of the immature forms include specimens from about 3 to 20 mm length. Identification of these early forms was necessary to establish the spawning period which extends from late October through July.

Growth of *S. leucopsarus* is quite rapid during the first year of life, when they attain an average of about 29 mm standard length; at the end of the second year they average 50 mm, and at the end of the third year 66 mm in standard length. Specimens of greater than 70 mm are not readily classified as to age group, because so few numbers are involved. The largest specimen taken is about 89 mm standard length. The use of scales or otoliths failed to establish year classes, and all analyses have been based on length-frequency distributions.

Two factors were found to influence the vertical distribution of *S. leucopsarus*: physiological age and light intensity. The larval forms are found in the upper 100 m range of depth, and are apparently strongly phototactic. The metamorphosing forms seek levels which are below that of the adult population, and after metamorphosis is established reascend to the upper limits of the range of the transformed individuals. These latter specimens have

a day-time distribution of between 220 and 500 m depth. At night they undertake a vertical migration toward the surface. This diurnal shift of the population is probably due to the species following an optimum of very low light intensity.

The seasonal distribution follows the three-phase hydrographic cycle characteristic of Monterey Bay. The population is in its greatest strength during the Davidson Current period (December to February), when the principal water flow is toward the shore. There is a rapid decline of the population during the upwelling period (February to July or August), when the principal currents tend away from the coast. During the oceanic period (July or August to December) there is no appreciable change in population strength over the previous hydrographic season, except for the strengthening of the first-year class due to increased availability as recently metamorphosed individuals.

The current patterns which influence the population strength are primarily wind induced. The water responding to the seasonal variation of wind direction is moved toward the shore during the Davidson Current period when the wind is from the south. During the upwelling period the wind is from the northwest, and water movement is away from the coast. During the oceanic period, a season of relative calms, the water movement tends to be largely restricted to such superficial layers that it has no appreciable effect upon the population strength of *S. leucopsarus*.

Certain factors of the physico-chemical environment apparently have no measurable effects upon the population dynamics. The evaluated features of the habitat (temperature, salinity, density, and oxygen concentration) do not appear to be limiting in the Monterey Bay area. The values of these variables were always found to be within the limits which are suitable for *S. leucopsarus*.

Microfilm \$2.75; Xerox \$5.60. 113 pages.

TREMATODE CERCARIAE FROM THE APALACHEE BAY AREA, WITH A SUMMARY OF THE LITERATURE ON MARINE CERCARIAE OF THE WORLD.

(L. C. Card No. Mic 60-3311)

Rhodes Burns Holliman, Ph.D.
The Florida State University, 1960

This is a morphological and taxonomic study of the trematode cercariae infecting 39 species of marine mollusks from Apalachee Bay, Gulf of Mexico. The investigation was conducted during the period September, 1956, to September, 1959. It is the first comprehensive report on these parasitic forms from the Gulf of Mexico, and all host and locality records herein are new.

Twenty-four new species of cercariae are described. Four previously reported cercariae are also included, with information on each hitherto unrecorded. These are: *Cercaria purpurae* Lebour, 1911; *Cercaria caribbea* III Cable, 1956; *Cercaria quissetensis* Miller and Northup, 1926; and *Cercaria caribbea* XXXVI Cable, 1956.

Nineteen species of gastropods were examined involving 13,961 individuals. Of this total, 2477 or 17.7% were infected with larval trematodes. Eighteen species of

cercariae are described and figured from gastropods. Ten species of pelecypods were examined involving 2616 individuals. Of this total, 145 or 5.5% were infected. Ten species are described and figured from bivalves.

The naming of new species is patterned after the system introduced by Sewell (1922) and modified by Cable (1956a) in which each cercaria is given a number preceded by a geographical term. This term in the present study is *apalachiensis*, which is derived from the name of the type locality.

The following numbers and family or superfamily types of new cercariae are described: one cyathocotylid; one schistosome; two aporocotylids; four furcocercous fellodistomatids; one tailless fellodistomatid; one bucephalid; three echinostomes; one monostome microphallid xiphidiodercaria; one distome plagiorchoid xiphidiodercaria; one cotylocercous monorchiid; one cotylocercous opecoelid or allocreadiid; one allocreadiid with long, glandular tail; one leptocercous allocreadiid; three pleurolophocercous heterophyids; one hemiuiroid; and one magnacercous cercaria of unknown affinity.

Contributions of the study include: evidence to support the contention that detailed specific diagnoses are necessary to separate closely related forms and that behavioral characteristics, vital dye reactions and germinal sac morphology are essential diagnostic features which should be recorded in all future cercarial descriptions; an emended general diagnosis of marine aporocotylid cercariae to include a form with extreme furcal asymmetry; the first flame cell patterns for marine aporocotylid cercariae; an extension of the diversity of flame cell patterns and the position and location of penetration glands in fork-tailed fellodistomatid cercariae; an emended general diagnosis of microphallid cercariae to include a form with 3 pairs of penetration glands and a flame cell pattern of $2[(2+2) + (2+2)]$; the description of the first opecoelid-allocreadiid-like cercaria with a tail other than cotylocercous, suggesting that tail morphology may not be of taxonomic significance for cercariae in these families; an extension of the known diversity of tail structure, penetration gland position and body pigment in heterophyid cercariae; and the description of a new hemiuiroid cercaria with primitive features which rival any previously described for cercariae in this group.

A review of the literature on marine cercariae of the world, up to January, 1960, is presented in the form of a table summarizing pertinent information concerning each cercaria. The known marine cercariae (324 species) are taxonomically separated according to the classification of LaRue (1957) and are placed in a key based on his system. This element of the study constitutes the first attempt to classify all described marine cercariae using the combined features of life history studies, embryonic development and general morphology as criteria.

Microfilm \$4.00; Xerox \$14.20. 311 pages.

INCIDENCE AND TRANSMISSION OF ANIMAL PARASITES IN SEWAGE AND CULINARY WATER

(L. C. Card No. Mic 60-6231)

Joseph Werneth Lepak, Ph.D.
University of Utah, 1960

Chairman: Albert W. Grundmann

The investigation consisted of a three-year study of the incidence of animal parasites as they occurred and were transported through a culinary water supply system. Deer Creek reservoir was chosen for the study because: (1) it is a major water source for Salt Lake City and the populated areas along the Wasatch Mountain front, (2) it was receiving organic contamination in the form of sewage plant effluent, sometimes only partially treated, and from extensive human use of the drainage area above and adjacent to the reservoir, and (3) during the period of study, the water drawn from the reservoir had no treatment other than chlorination.

Although a great deal of study has been completed relating to the transmission of bacterial disease through culinary water, only a few studies have been made on the transmission of animal parasites by culinary distribution systems and no work has been previously done in Utah.

The study was carried out using one-half to three liter water and sewage samples collected at stations located as follows: (1) untreated water entering the Salt Lake City aqueduct, (2) raw, primary and secondary effluent from the Heber City sewage plant, (3) chlorinated water at the Terminal reservoir in Salt Lake City, (4) Provo River water above the Deer Creek reservoir and (5) all areas of Deer Creek reservoir. Additional studies were carried out using sand filtration and membrane filter units on untreated water entering the Salt Lake aqueduct and chlorinated water entering the Terminal reservoir. The sand filtration unit represented one weeks filtration of approximately 1.5 gallons of water per hour. Some 624 samples of water and sewage were examined, 70 of which were taken from sand filter concentrates.

The sand filtration and membrane filter units were constructed by the author and evaluated for performance using a known number of parasitic organisms per liter of water. The recovery of these indicated that the apparatus was at least 84 per cent efficient against *Ascaris* ova and 35 per cent efficient against cysts of *Endamoeba coli*, a form similar in size to *E. histolytica*.

Concentrates were cultured and examined microscopically for parasitic forms. In addition, coliform counts were made at critical points and periods in an attempt to correlate presence of animal parasites with organic pollution.

The lack of correlation in recovery of organisms from sewage effluent and from filter concentrates taken at the intake to the aqueduct indicates that the biota of the reservoir and normal sedimentation of water, during most of the year, removes many of the organisms present in the river and sewage water. However, there is evidence that some organic material passes directly through the reservoir. Studies to elucidate these effects by means of radioisotopes were prohibited by the Utah State Board of Health.

Ascaris ova, probably of animal origin, were recovered from untreated water at the point of entrance to the Salt

Lake aqueduct. The presence of ova at this point suggests that these forms reached the distribution system and that other parasitic forms could also enter the system. Chlorination in this water is maintained at levels below that necessary to destroy viable ova.

Cultures inoculated with sewage concentrates did not reveal the presence of *E. histolytica*, but did produce a species of *Endamoeba* resembling this form. *Endamoeba coli*, another such form, was also recovered from sewage effluent. The presence of these forms in the sewage effluent suggests that pathogenic forms, present in appreciable numbers, could be transported to reservoir water from this source of pollution.

Coliform counts indicated that no positive correlation existed between the numbers of bacteria present in the untreated water and the numbers of *Ascaris* ova recovered during the same period of time.

The sand filter was found to be effective in recovering helminth ova from untreated water. It is suggested that the method, with modifications, be utilized for similar studies in the future.

The membrane filter, as used here, was found to be unsatisfactory because of its restricted filtering capacity.

Nematode larvae were recovered from all sampling stations. Recent studies have shown that these worms are potential vectors of disease in water supplies. In the absence of complete water treatment, these forms are potential disease hazards.

The low incidence of human parasitic forms recovered from sewage and water, is correlated to the reported low parasitic index of infection in the population living on the Deer Creek water-shed and in the Salt Lake valley.

Microfilm \$2.75; Xerox \$3.80. 69 pages.

STUDIES ON THE CARYOPHYLLAEIDAE (CESTODA) OF THE WHITE SUCKER, *CATOSTOMUS COMMERSONI* (LACEPEDE) IN NORTHERN COLORADO.

(L. C. Card No. Mic 60-6797)

Robert Charles McCrae, Ph.D.
Colorado State University, 1960

Approximately 200 specimens of *Catostomus commersoni*, the white sucker, from Northern Colorado were examined in order to collect and study the species of Caryophyllaeidae infecting them.

Five species of caryophyllaeids occur in *C. commersoni* in the study area. These include *Glaridacris catostomi* Cooper, 1920, *G. oligorchis* Haderlie, 1953, *Biacetabulum biloculoides* n. sp., *B. macrocephalus* n. sp., and *Hunterella nodulosa* n.g., n.sp. The new species are fully described, while supplementary morphological data not previously provided is given for *G. oligorchis*. In addition, several morphological variations are noted for *G. catostomi* and *G. oligorchis*. Morphological descriptions of the egg, embryo, larva, and immature stages of *G. catostomi*, *G. oligorchis* and *H. nodulosa* are presented. Keys are given for the genera of the Caryophyllaeidae, and for the species of *Biacetabulum* and *Glaridacris*.

The life cycles of *G. catostomi*, *G. oligorchis* and *H. nodulosa* were studied experimentally. The results show

that the pattern of development of these three cestodes is nearly identical. The eggs are undeveloped at the time of deposition and are passed in this stage with the feces of the sucker into the water. Embryonation occurs in the water in 10 to 22 days depending on the species. An unciliated embryo is produced which does not hatch until ingested by a tubificid intermediate host. The period required for embryonation varies slightly between each species, their ranges, however, overlap.

Experimental investigations and specimens collected from nature provided larval infection of *G. catostomi*, *G. oligorchis* and *H. nodulosa* only in the tubificid annelid *Limnodrilus udekemianus*. The annelid acquires the infection by ingestion of embryonated eggs. The larval cestodes have a caudal cercomere bearing six embryonic hooks and are located in the body cavity of their host.

Experimental infection of the definitive host was not successful, however, the evidence strongly indicates that the suckers acquire infection by ingestion of infected tubificids.

The results of this study and those cited in the literature show that the pattern of development of the Caryophyllaeidae differs markedly from the cyclophyllidean, pseudophyllidean and protocephalid types. The caryophyllaeid life cycle, therefore, is considered to be a fourth and definitely distinct type.

Of the species investigated, *H. nodulosa* is the only one that causes a detectable pathological condition in the definitive host. The larvae of *G. catostomi* and *H. nodulosa* were observed to cause the loss of posterior portions of the body of their tubificid host.

G. catostomi, *G. oligorchis* and *H. nodulosa* were the most abundant species and were found in suckers from all sources studied, whereas *B. biloculoides* and *B. macrocephalus*, both relatively rare, were obtained from only two sources.

B. macrocephalus, *G. oligorchis* and *H. nodulosa* show their greatest abundance and highest frequency of infection in the flowing waters of the Cache la Poudre River, while *B. biloculoides* and *G. catostomi* are most common in the impounded waters of lakes and reservoirs.

Specimens of *Catostomus catostomus*, the longnosed sucker, taken from the same habitats as were infected *C. commersoni* were not infected with any caryophyllaeid cestodes.

In relation to the findings of this investigation and previous information cited in the literature, Wardle and McLeod's (1952) scheme of classification for the caryophyllaeidae is followed in this study. Yamaguti's (1959) treatment of the Caryophyllaeidae is not acceptable at this time. The generic name *Szidatinus* is proposed to replace *Brachyurus* Szidat, 1938 which is not available due to pre-occupation. Microfilm \$2.75; Xerox \$8.80. 195 pages.

BIOLOGY OF SPLENDIDOFILARIA QUISCALI
(VON LINSTOW, 1904) N. COMB.
(NEMATODA: ONCHOCERCIDAE).

(L. C. Card No. Mic 61-462)

Joshua Adeniran Odetoyinbo, Ph.D.
Iowa State University of Science and Technology, 1960

Supervisor: Martin J. Ulmer

Examination of 112 bronzed grackles (*Quiscalus quiscula versicolor* Vieillot, 1819) trapped in the vicinity of Ames, Iowa (1957-1959) revealed that 45 harboured from one to 61 adult *Splendidofilaria quiscali* (von Linstow, 1904) n. comb. producing sheathed microfilariae with blunt anterior and posterior extremities. Six harboured microfilariae of another type, and 19 had double infections. Ten of the 42 uninfected birds were nestlings.

Adults of *Splendidofilaria quiscali* are remarkably restricted to the lateral ventricles of the brain, except in heavily infected birds where they also occur at the posterior borders of the cerebrum. Here they lie immediately beneath the pia mater. Microfilariae are probably released into the ventricles from where they eventually reach the blood circulation via the lymphatics.

Apparently, adults and microfilariae produce no appreciable pathological effects on grackles. Examination of cross, frontal and sagittal serial sections of infected brains revealed no evidence of necrosis, hyperemia, external or internal hydrocephalus, haemorrhage, thrombosis, embolism, meningitis, encephalitis or ependymitis, neither did microfilariae produce any pathological lesions in cardiac or lung tissues.

In general, female worms predominate, and it is not uncommon to discover infections involving no males. Thus the absence of microfilariae from the blood is not always a sure indication of non-infection.

Intensive studies on microfilarial periodicity indicate that *Microfilaria quiscali* exhibits well-marked nocturnal periodicity, with maximum numbers generally occurring around midnight. When normal periods of darkness and light were interchanged by the use of artificial light, periodicity was reversed. Five days of continuous exposure to light disrupted normal periodicity in all but one of six experimental birds. Normal nocturnal periodicity was re-established by maintaining these birds for five days under normal conditions of light and darkness; however, maximum numbers of microfilariae were far less than those obtained under conditions of continuous light. Five consecutive days of continuous darkness apparently had no effect on normal periodicity.

All periodicity experiments involved the withdrawal of 0.0125 ml. blood from metatarsal veins of experimental birds every two hours for 48 to 72 consecutive hours. This technique is rapid, permits examinations at frequent intervals, obviates the necessity of haemolysing or centrifuging the blood, and eliminates mathematical errors often associated with dilution and concentration of microfilariae.

Living adult worms were maintained for more than two weeks in the brains of decapitated birds kept at 5°C. Living microfilariae were recovered from the heart of birds killed 18 days previously. Microfilariae from freshly killed birds were kept alive for 17 days in citrated blood maintained at 3°C. under aseptic conditions.

Of four non-infected grackles transfused with microfilaremic blood (two intraperitoneally, and two partly intravenously, partly intramuscularly), none showed microfilariae in peripheral circulation. However, one of the latter exhibited living microfilariae in the heart four months after transfusion. Microfilariae transfused intravenously into four chickens remained alive in peripheral circulation for at least 31 days, and exhibited an apparent nocturnal periodicity. Chickens transfused intraperitoneally never showed microfilariae in peripheral circulation.

Experimental attempts to elucidate the life cycle of *Splendidofilaria quiscali* using four species of mosquitos (*Culex pipiens*, *Culex tarsalis*, *Aedes triseriatus* and *Aedes aegypti*), two species of mites (*Ornithonyssus sylvii* and *Dermanyssus gallinae*), laboratory-reared *Simulium* spp. and stable flies (*Stomoxys calcitrans*) were all unsuccessful. Neither the simuliids nor stable flies bit the grackles, and in none of the 481 engorged mosquitos and 250 mites exposed to infected grackles were any developmental changes noticed in ingested microfilariae. Microfilm \$2.75; Xerox \$6.80. 145 pages.

**A STUDY OF THE OSTEOLOGY
OF THE AMERICAN SMELT,
OSMERUS MORDAX (MITCHILL).**

(L. C. Card No. Mic 60-6968)

Jagat Pal Singh, Ph.D.
Michigan State University, 1959

Major Professor: Peter I. Tack

The American smelt, *Osmerus mordax* (Mitchill) is classified under the family, Osmeridae by recent ichthyologists, Berg (1940); and Hubbs and Lagler (1947).

The skeleton of the smelt is a typical teleostean fishes of the suborder, Salmonoidea.

The olfactory region contains the paired proethmoids, prefrontals, vomers, nasals and the unpaired ethmoid.

The orbital region contains the paired circumorbital series of bones, frontals and sphenotics.

The otic region contains the paired pterotics, epiotics, parietals, post-temporals and the unpaired supraoccipital, the paired exoccipitals, prootics and supracleithrums.

The basicranial region contains the unpaired basioccipital and parasphenoid.

The oromandibular region contains the paired palatines, quadrates, articulars, metapterygoids, entopterygoids, pterygoids, premaxillaries, maxillaries, supramaxillaries, angulars and dentaries.

The hyoid region contains the paired hyomandibulars, symplectics, interhyals, epihyals, ceratohyals, hypohyals, operculars, preoperculars, suboperculars, interoperculars, branchiostegals and the unpaired basihyal and urohyal.

The branchial region contains the paired pharyngo-branchials, epibranchials, ceratobranchials, hypobranchials and the unpaired basibranchial.

The skeleton of the smelt and the salmon show differences sufficient for recent ichthyologists to classify them in the separate families, Osmeridae and Salmonidae, retaining them in the same suborder, Salmonoidea.

The vertebral column, dorsal fin, pectoral fins, pelvic fins, anal fin and caudal fin are very similar to the typical teleostean fishes.

Microfilm \$2.75; Xerox \$5.60. 114 pages.

**TISSUE CULTURE AS A TOOL FOR
THE INVESTIGATION OF HOST-PARASITE
RELATIONSHIPS OF *PLASMODIUM*
ELONGATUM IN DUCKLINGS**

(L. C. Card No. Mic 61-529)

Margaret Louise Weiss, Ph.D.
Syracuse University, 1960

The primary object of this investigation was to elucidate to some extent the host-parasite relationships and immune reactions of malaria parasites.

Plasmodium elongatum and, to a lesser extent, *P. vauhani* were chosen as test organisms because they display abundant exo-erythrocytic stages in, among others, cells which normally form an important part of the host's defensive forces because of their phagocytic abilities.

In order to isolate to some extent these exo-erythrocytic stages and their host cells from the rest of the organism, *in vitro* cultivation of parasitized liver, spleen and bone marrow was undertaken. Cultures were established in Porter flasks containing flying coverslips in a medium consisting of a balanced salt solution, chick serum, antibiotics, and an indicator, and incubated at 39.5°C.

It is believed that normal growth and development of *P. elongatum* for 72 hours was achieved. Morphological appearance of parasites in the cultures was normal, and all stages of the schizogonic cycle were observed in a variety of host cells, comparable to conditions prevailing *in vivo*.

Cultures upon injection into susceptible birds gave rise to infections which differed in no way from those obtained when similar cells were directly transferred into new birds. The incubation period for infections induced by inoculation of small amounts of tissues from acute infections, either directly or after a term in *in vitro* culture, was observed to be a very uniform 7-8 days, whereas tissues from latent infections, treated in the same manner, gave rise to infections which did not become apparent until the 11th - 15th day.

That this lag period was not due to the extremely low numbers of parasites in such tissues was shown by a series of dilution experiments, in which it was noted that even very small numbers, possibly single parasites, derived from acute cases, always gave rise to patent infections after 7-8 days, if an infection resulted at all.

It is thought to be significant that infections induced by tissue cell suspensions from different organs derived from the same donor bird showed great uniformity in this respect, the infections becoming patent within a day of each other.

It is therefore concluded that invaded cells may, after the acute stage of the infection, elaborate some hypothetical inhibitor which arrests multiplication of the parasite, while not interfering with its viability or virulence.

The patchy distribution of parasites in the older cultures as well as the almost exclusively exo-erythrocytic character of infections induced by such cultures in canaries

leads to the conclusion that adaptation and selection take place under these conditions.

Results of treating ducklings suffering from P. elongatum infections with immune or hyperimmune serum were entirely negative, and the conclusion is drawn that this aspect of host defence is, as in other plasmodia with a high histiotropic/haemotropic ratio, of negligible importance.

Attempts at cultivation of P. vauhani were quite abortive, though the cultures were infective for susceptible canaries for a period of 24 hours. It is thought possible that this was due to maintenance of resistant merozoites for this period of time; but not to healthy growth and development of this parasite.

Microfilm \$2.75; Xerox \$6.00. 123 pages.

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